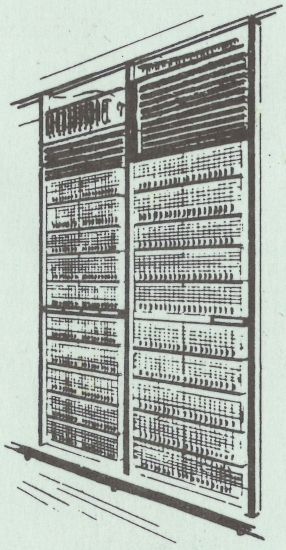
NO. 5 CROSSBAR DIAL TELEPHONE SYSTEM

SKETCHES

EDUCATIONAL BULLETIN NO. 2.5B-2

Issued December 1948



Western Electric Company
INCORPORATED
HAWTHORNE WORKS

Central Region Engineering · Technical Training Section

Western Electric Company, Inc.
Central Region Engineering
Technical Training Section

Educational Bulletin No. 2.5B-2

CROSSBAR NO. 5 DIAL TELEPHONE SYSTEM SKETCHES

This bulletin is issued to provide general information concerning the relationship between equipment and frames used in the Crossbar No. 5 Dial Telephone System. Information contained herein is to be used for educational purposes only.

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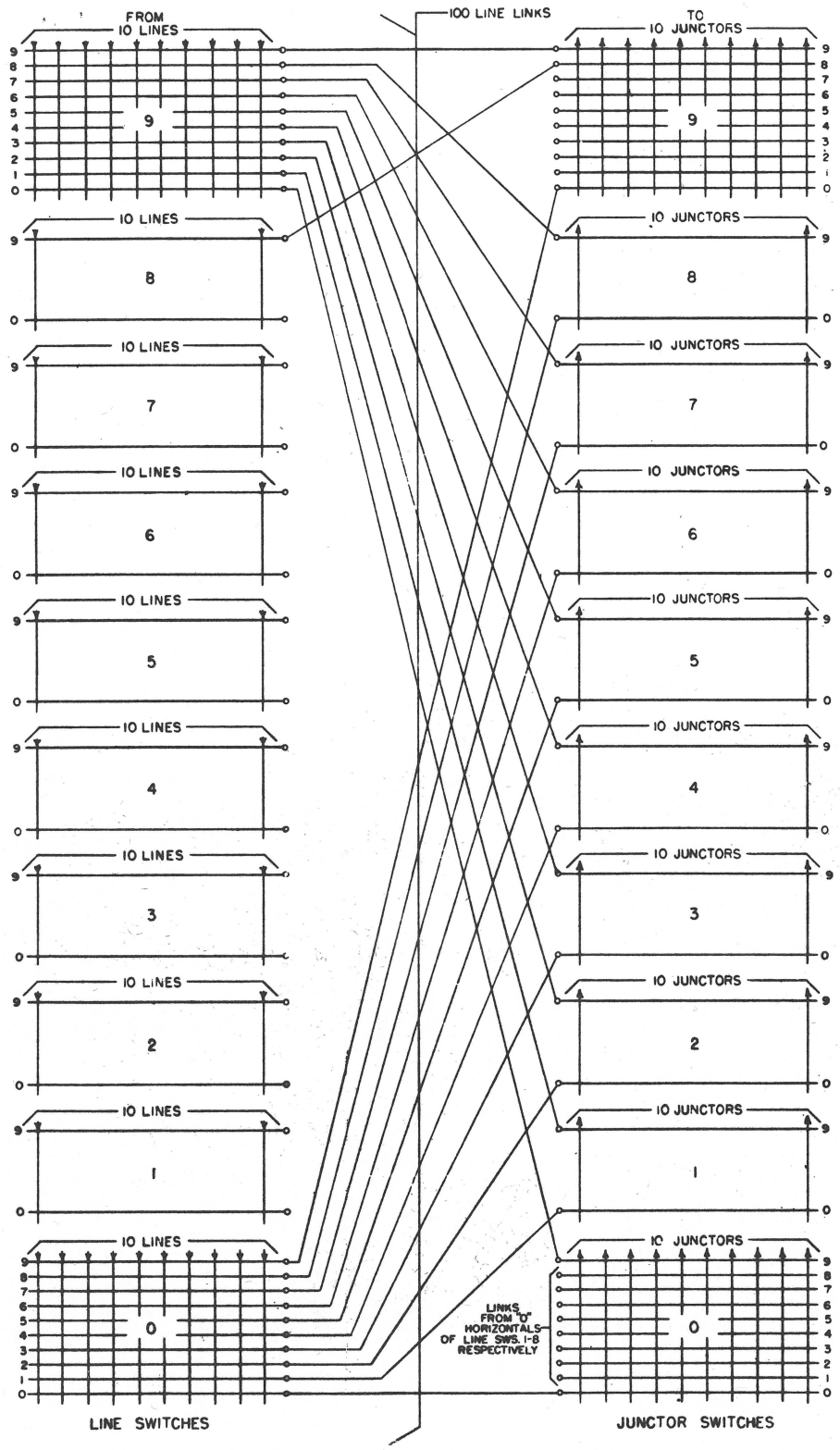
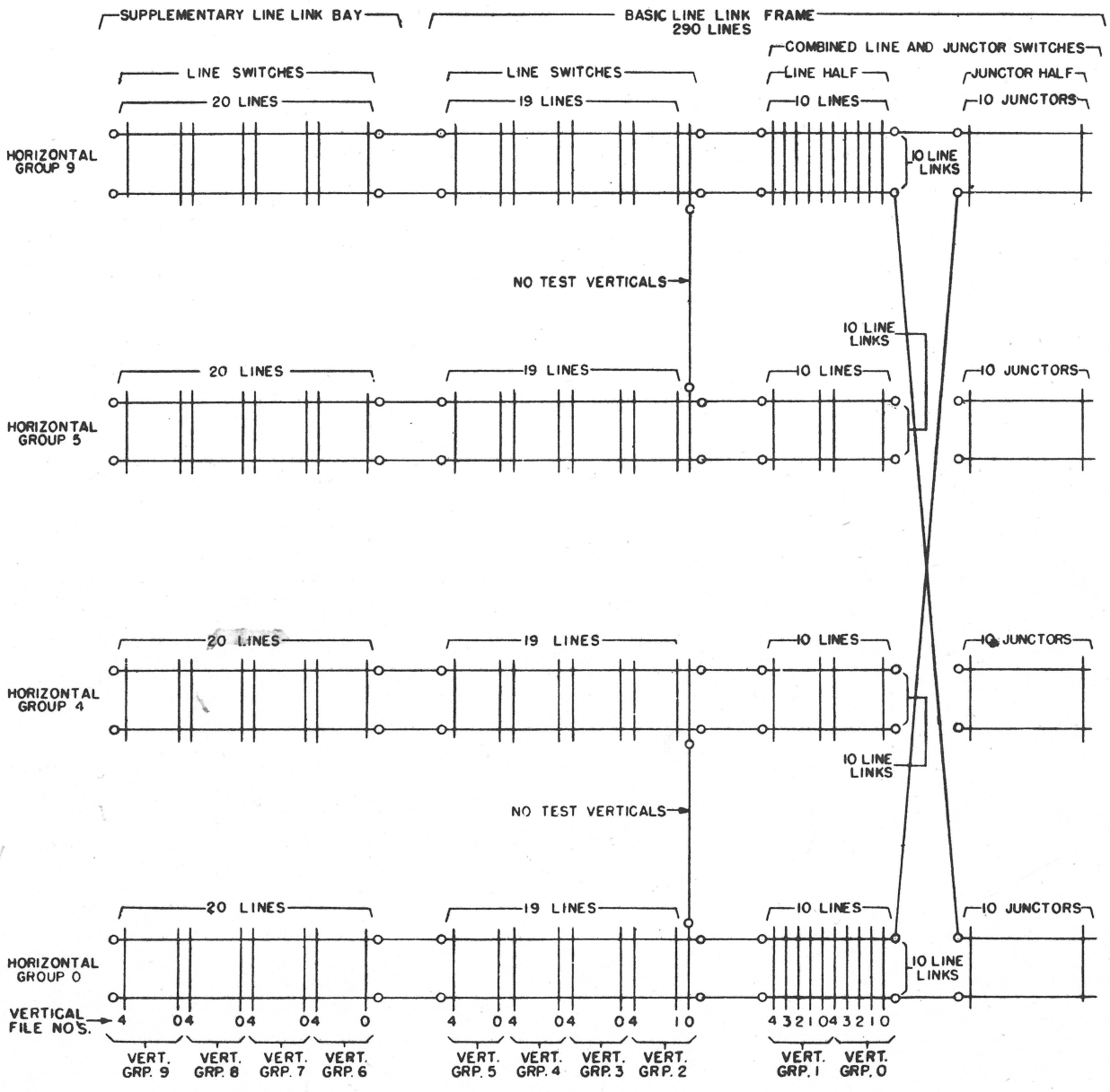


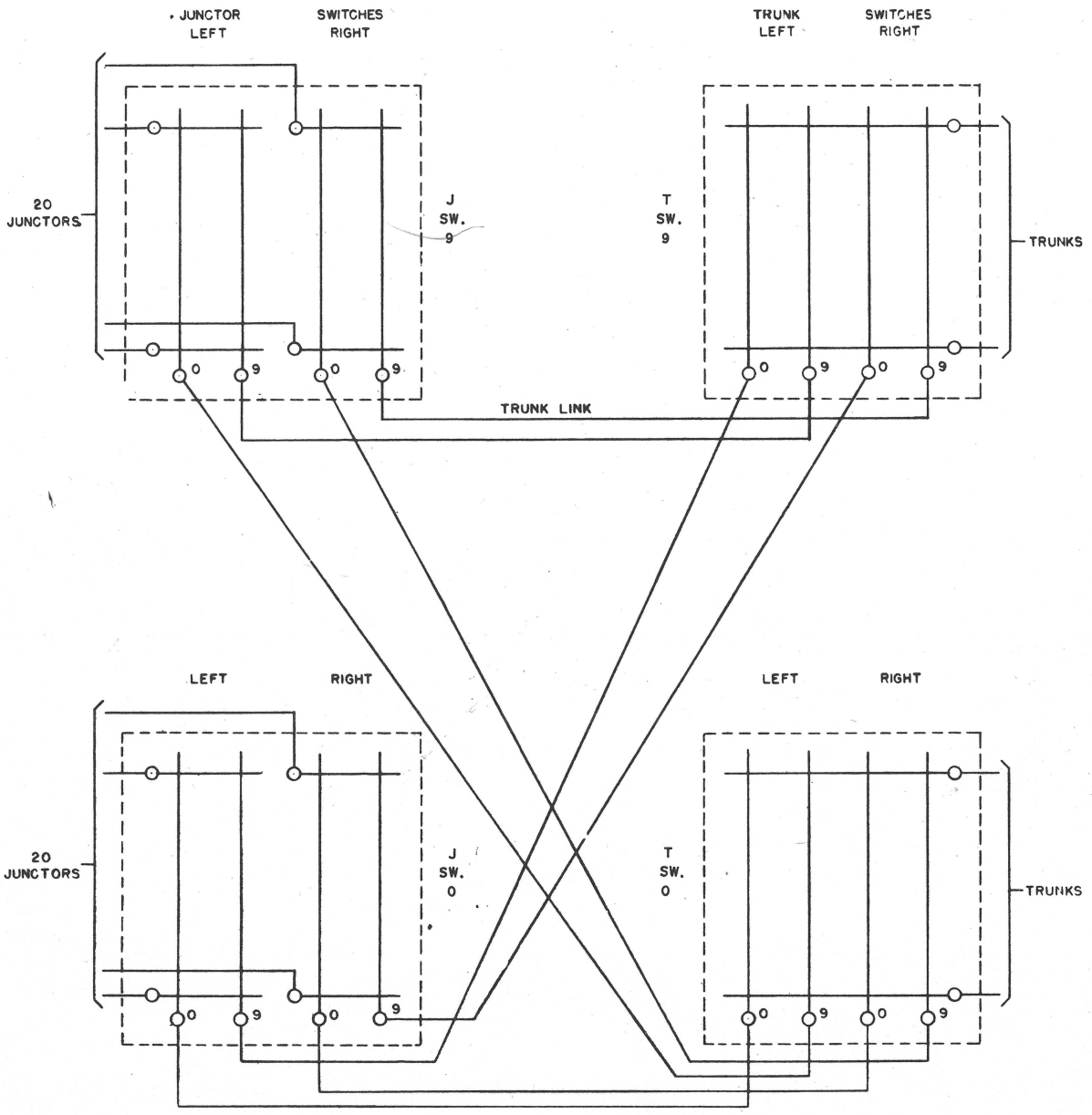
LINE LINK SPREAD

FIG.5B-010



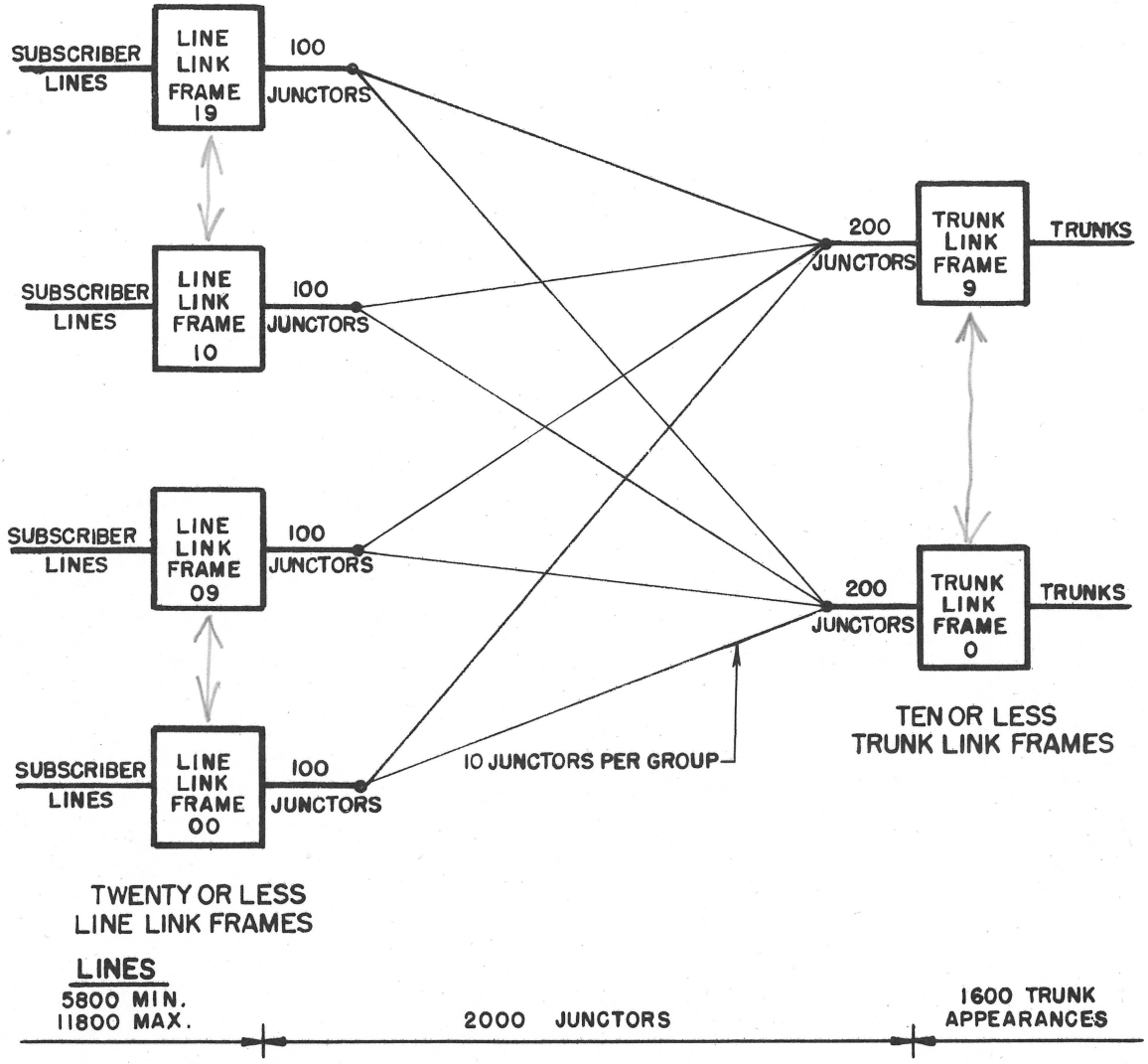
LINE LINK FRAME SCHEMATIC, WIRING SIDE
FRAME ARRANGED FOR 490 LINES

FIG. 5B-011



TRUNK LINK SPREAD

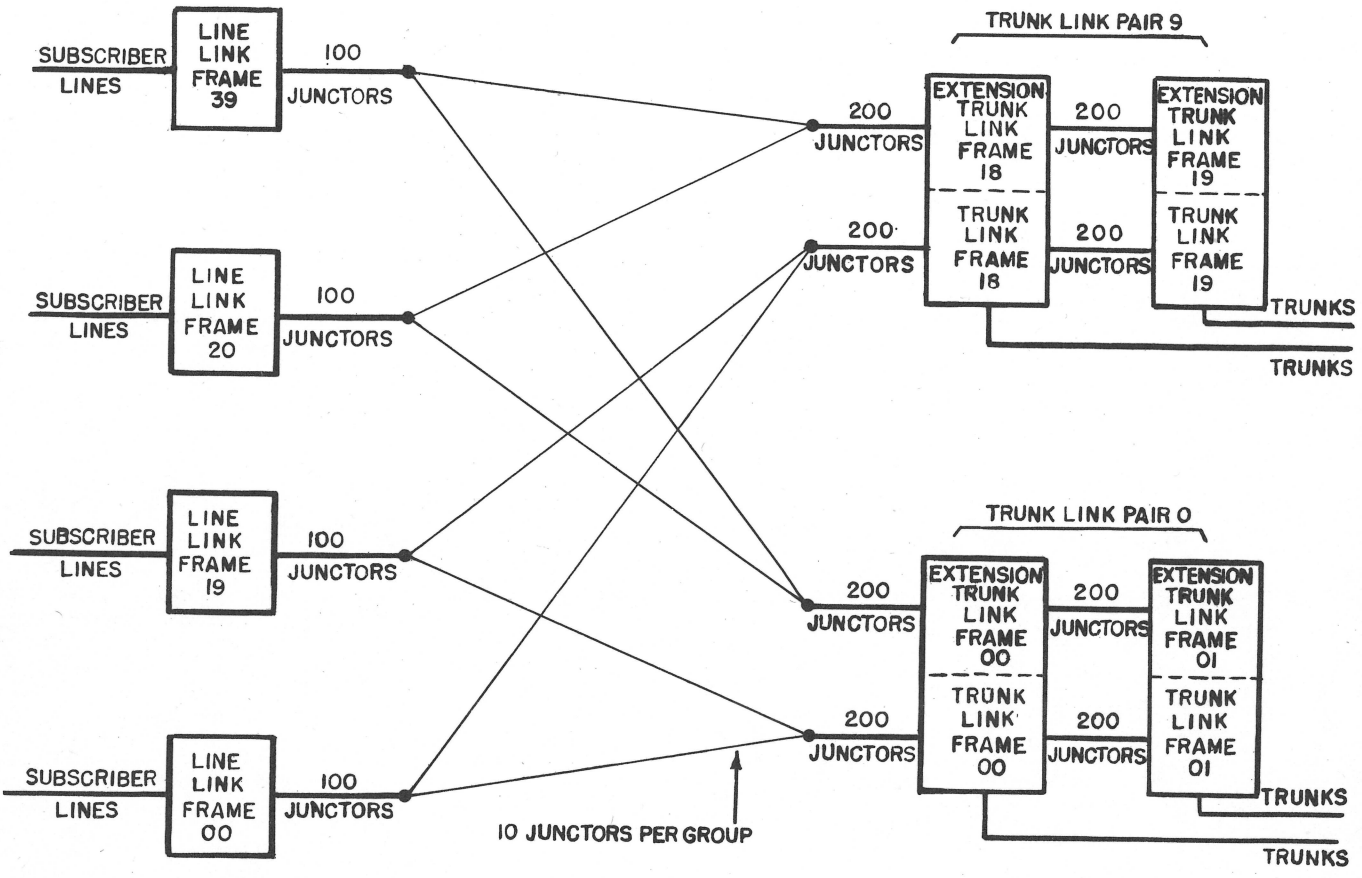
FIG.5B-012



JUNCTOR DISTRIBUTION

10 OR LESS TRUNK LINK FRAMES

FIG.5B-020

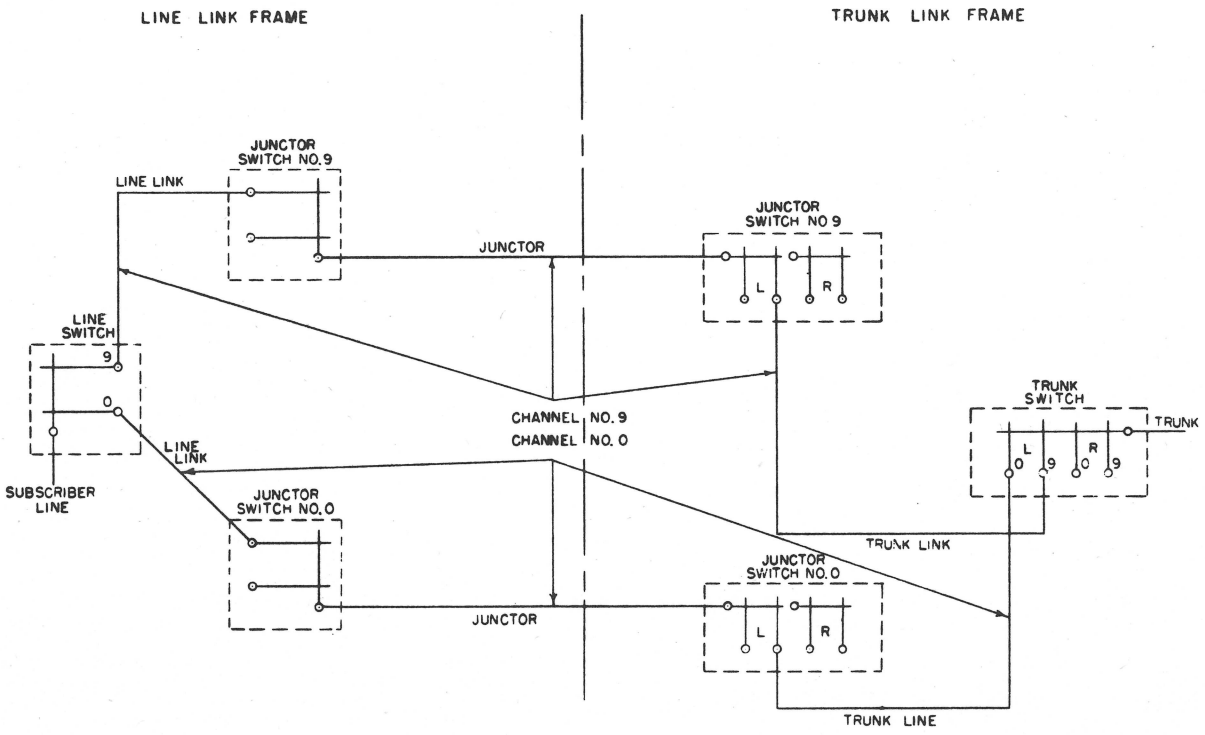


JUNCTOR DISTRIBUTION

WITH

PAIRING OF TRUNK LINK FRAMES

FIG.5B-021

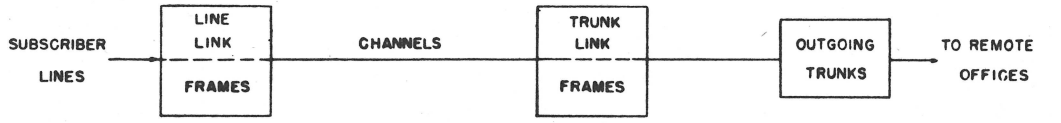


NOTE:

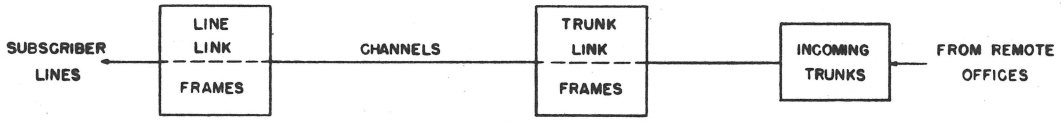
THE CHANNEL NUMBER ALWAYS CORRESPONDS TO THE LINE SWITCH HORIZONTAL NUMBER OF THE LINE LINK, THE TRUNK SWITCH VERTICAL NUMBER OF THE TRUNK LINK, AND THE JUNCTOR SWITCH NUMBER. ALL OTHER ELEMENTS ARE NUMBERED INDEPENDENTLY OF CHANNEL NUMBER CONSIDERATIONS.

CHANNELS

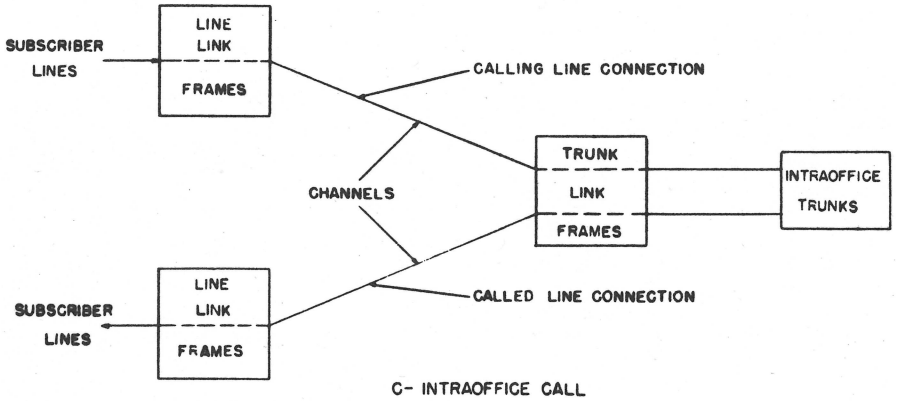
FIG.5B-030



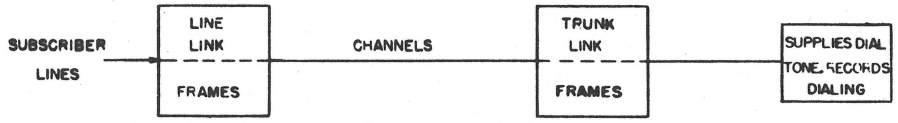
A- OUTGOING CALLS



B- INCOMING CALLS



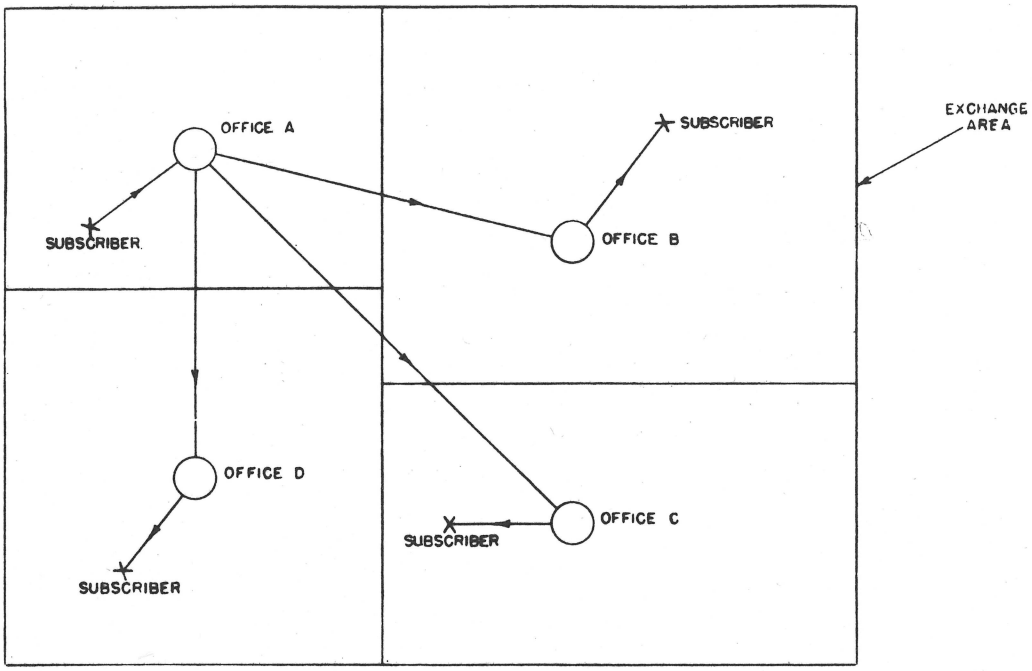
C- INTRAOFFICE CALL



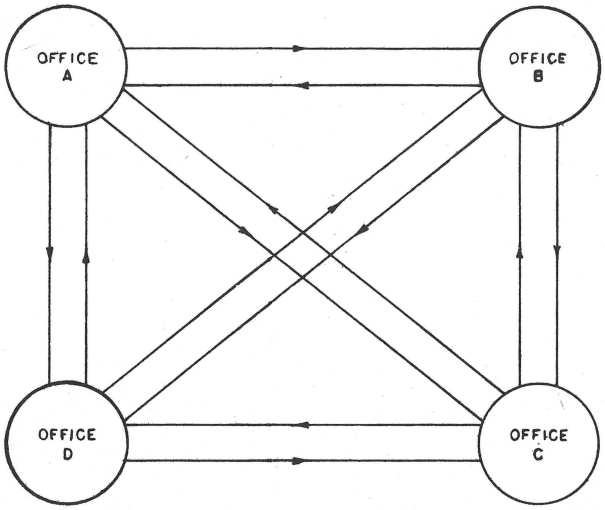
D- DIALING CONNECTION

COMMON USE OF CHANNELS

FIG.5B-031

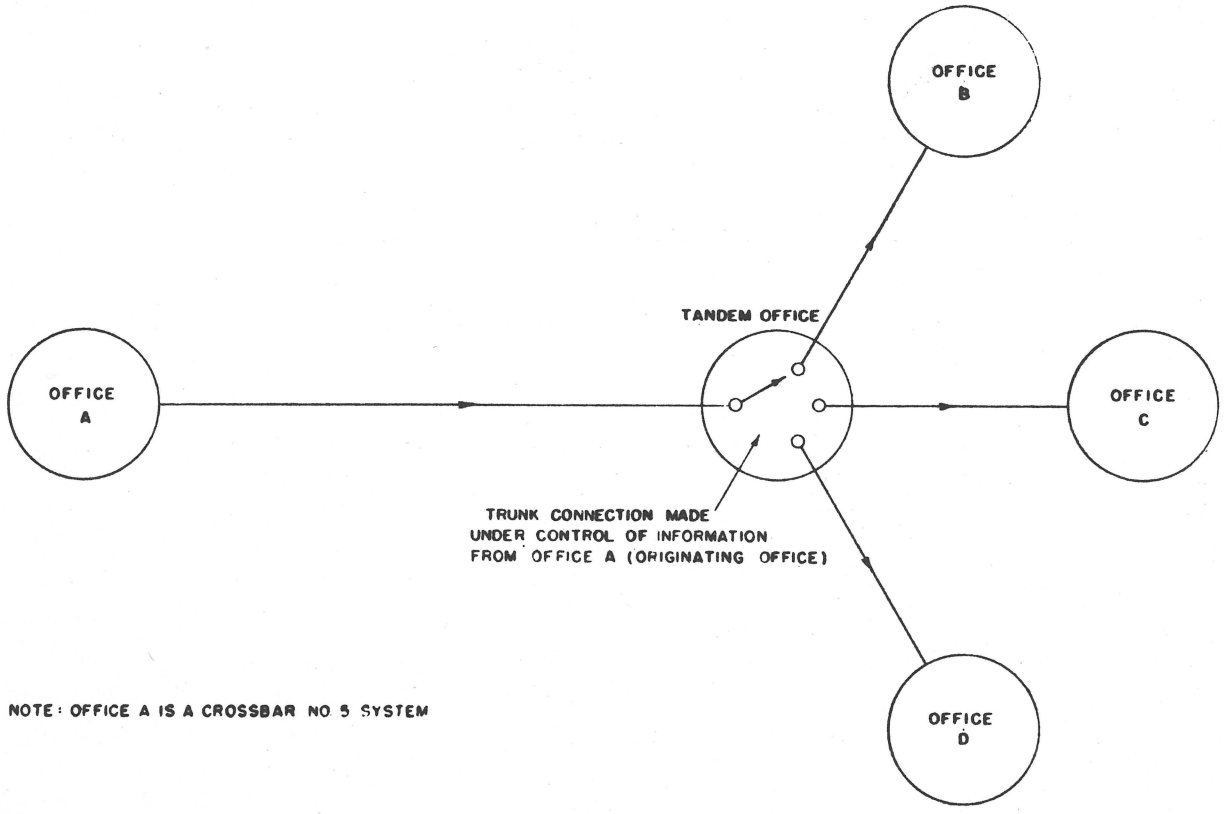


DIRECT TRUNK ROUTES FROM OFFICE A



DIRECT TRUNK ROUTES FOR ALL OFFICES

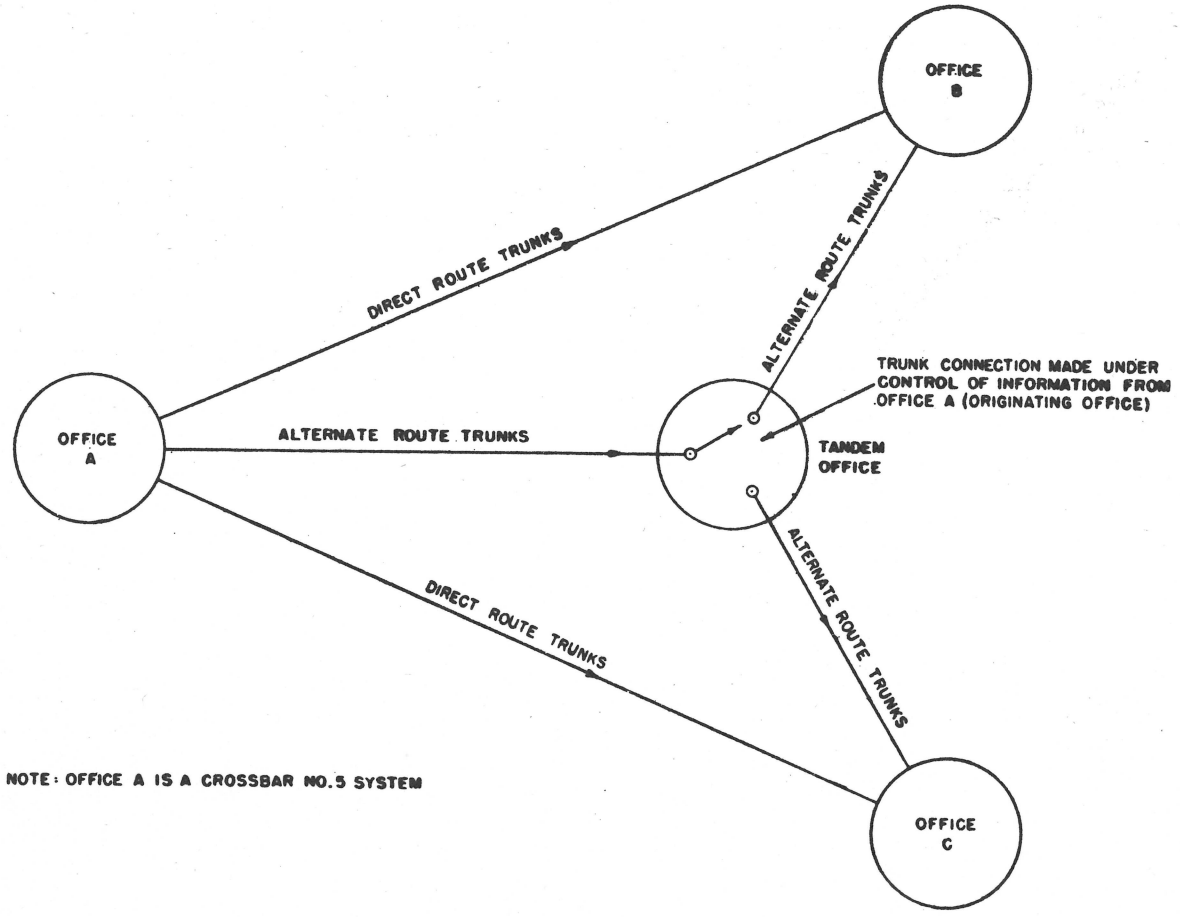
DIRECT TRUNK ROUTE PRINCIPLE



NOTE: OFFICE A IS A CROSSBAR NO 5 SYSTEM

TANDEM ROUTE PRINCIPLE

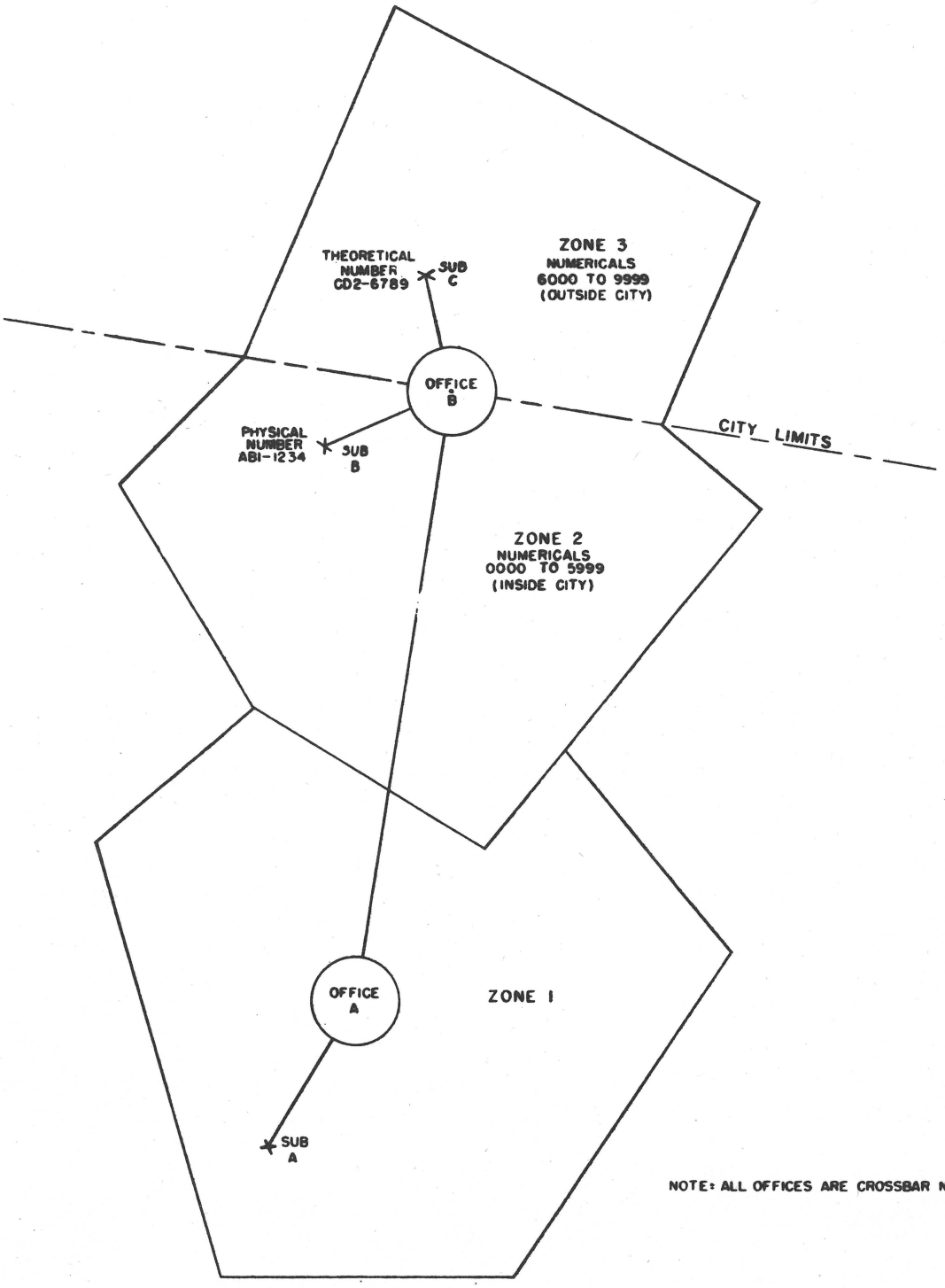
FIG.5B-041



NOTE: OFFICE A IS A CROSSBAR NO.5 SYSTEM

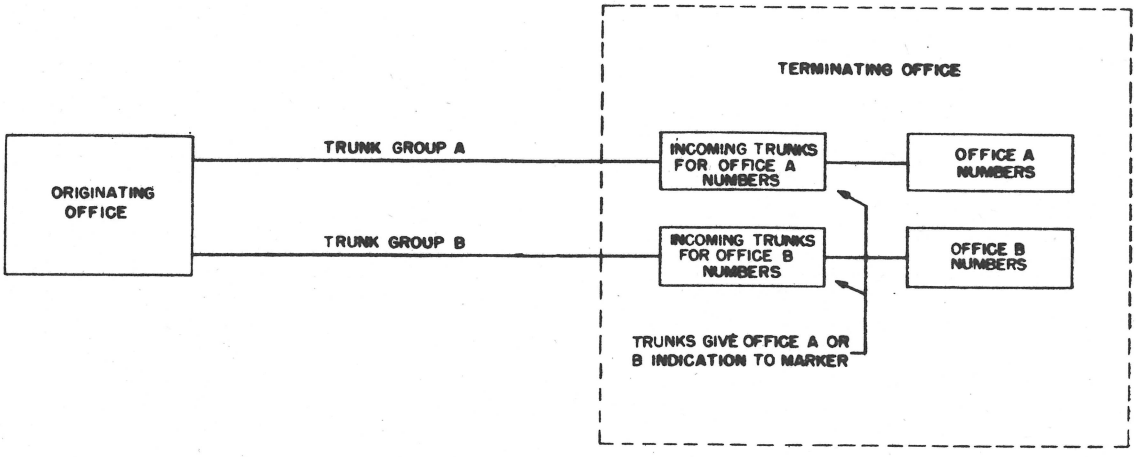
DIRECT & ALTERNATE ROUTES
ROUTES FROM OFFICE A TO OFFICES B & C

FIG.5B-042



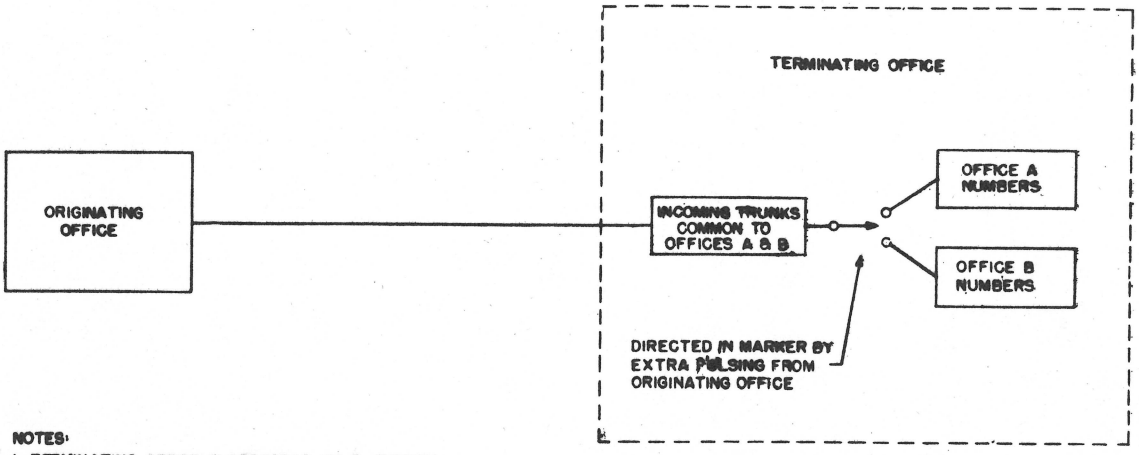
EXCHANGE AREA WITH ZONING

FIG. 5B-043


TERMINATING OFFICE
ORIGINATING OFFICE
TRUNK GROUP A
TRUNK GROUP B
INCOMING TRUNKS FOR OFFICE A NUMBERS
INCOMING TRUNKS FOR OFFICE B NUMBERS
OFFICE A NUMBERS
OFFICE B NUMBERS
TRUNKS GIVE OFFICE A OR B INDICATION TO MARKER

NOTES:
1. TERMINATING OFFICE IS CROSSBAR NO. 5 SYSTEM.

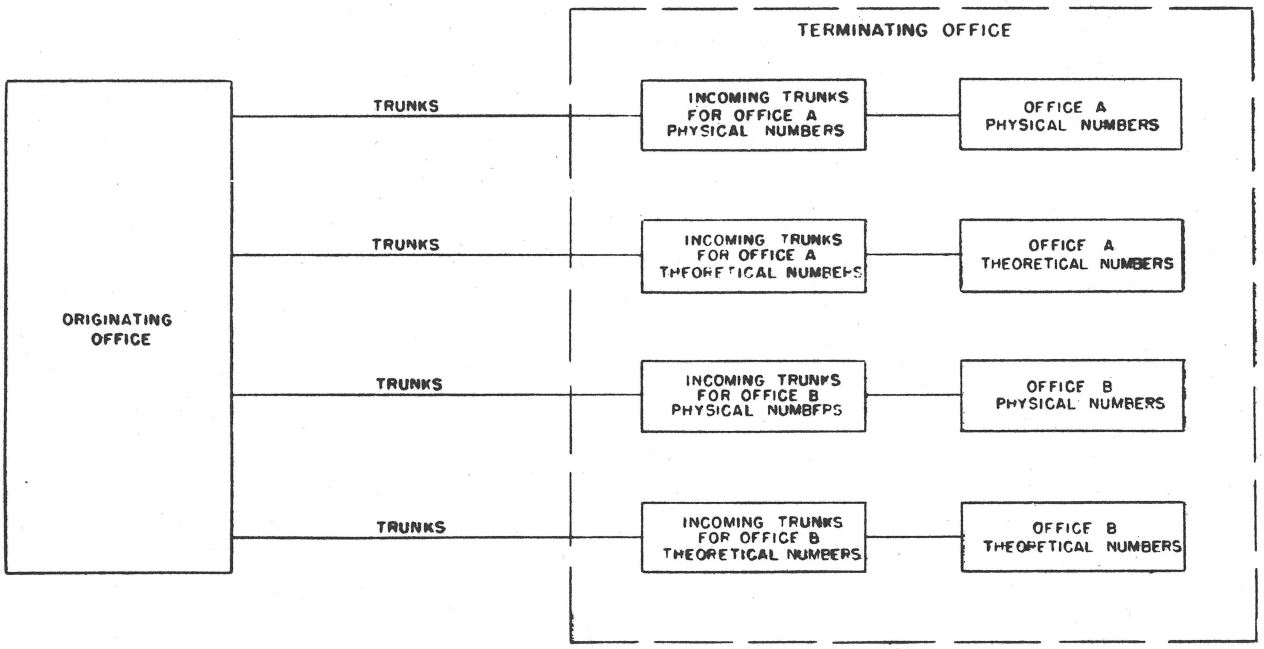
OFFICE INDICATION BY TRUNK GROUPS, INCOMING CALL


TERMINATING OFFICE
ORIGINATING OFFICE
INCOMING TRUNKS COMMON TO OFFICES A & B
OFFICE A NUMBERS
OFFICE B NUMBERS
DIRECTED IN MARKER BY EXTRA PULSING FROM ORIGINATING OFFICE

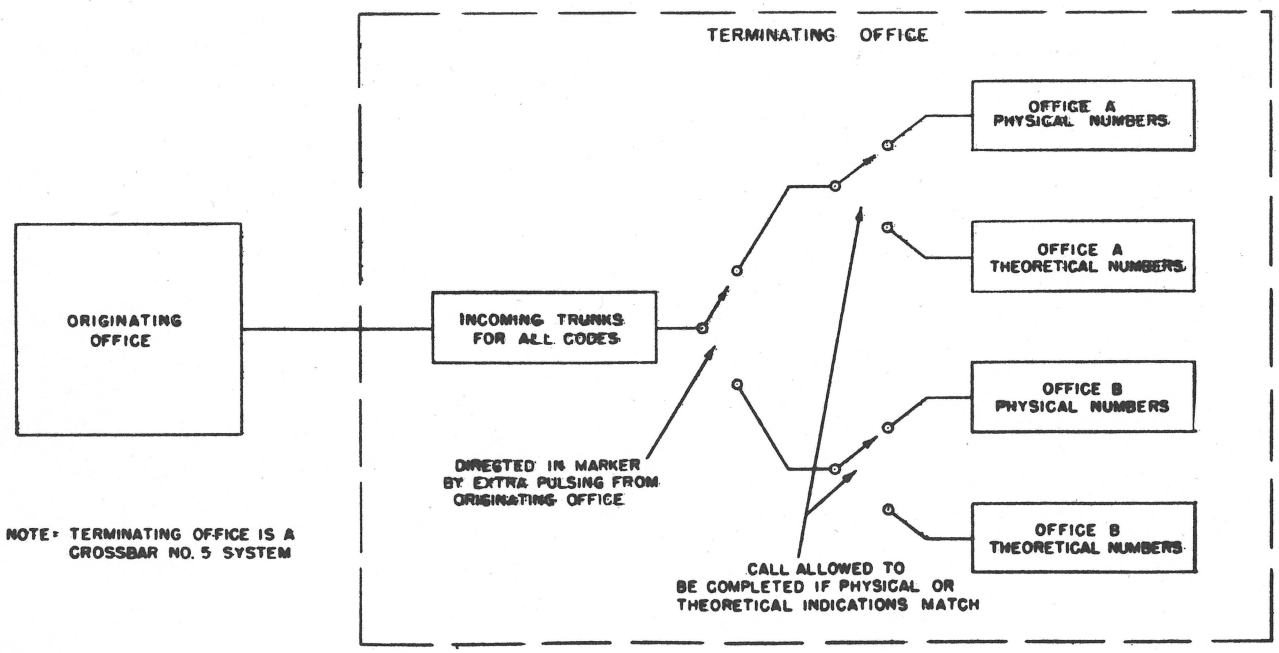
NOTES:
1. TERMINATING OFFICE IS CROSSBAR NO. 5 SYSTEM.

OFFICE INDICATION BY EXTRA PULSING, INCOMING CALL
MULTI-OFFICE TRUNK GROUPS, COMMON AND INDIVIDUAL

FIG. 5B-044

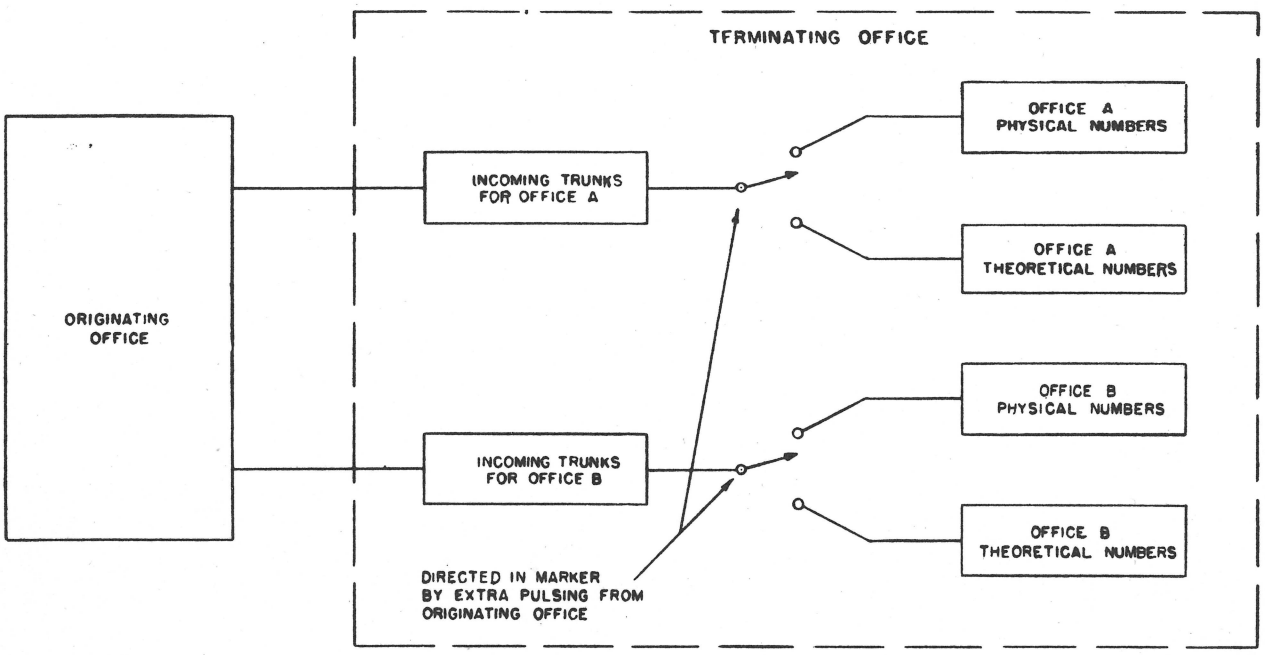


OFFICE & PHYSICAL-THEORETICAL INDICATION BY TRUNK GROUPS


TERMINATING OFFICE
ORIGINATING OFFICE
INCOMING TRUNKS FOR ALL CODES
DIRECTED IN MARKER BY EXTRA PULSING FROM ORIGINATING OFFICE
CALL ALLOWED TO BE COMPLETED IF PHYSICAL OR THEORETICAL INDICATIONS MATCH
OFFICE A PHYSICAL NUMBERS
OFFICE A THEORETICAL NUMBERS
OFFICE B PHYSICAL NUMBERS
OFFICE B THEORETICAL NUMBERS
NOTE: TERMINATING OFFICE IS A CROSSBAR NO. 5 SYSTEM

OFFICE & PHYSICAL - THEORETICAL INDICATION BY EXTRA PULSING
MULTI-OFFICE TRUNK GROUPS, PHYSICAL - THEORETICAL

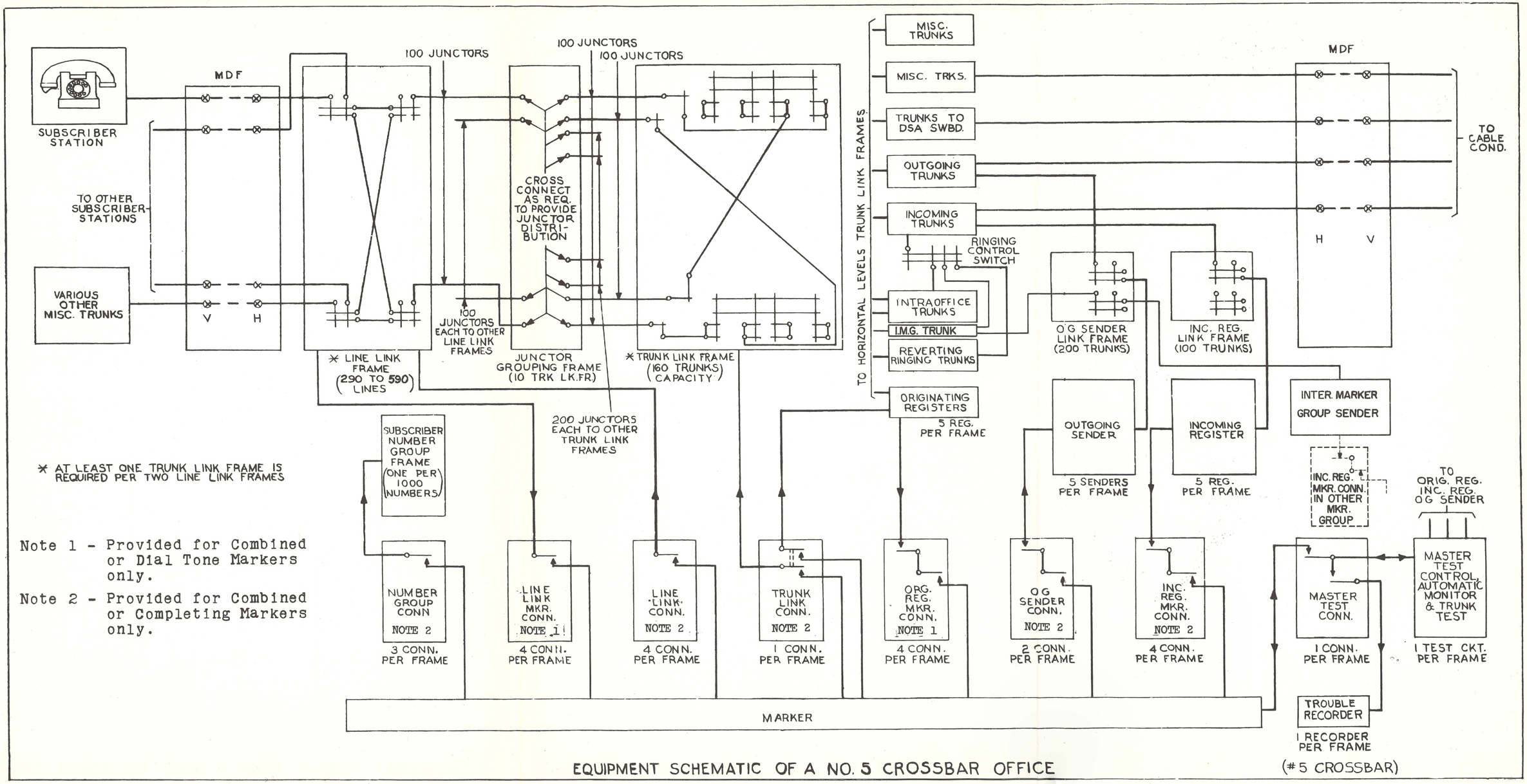
FIG.5B-045


TERMINATING OFFICE
ORIGINATING OFFICE
INCOMING TRUNKS FOR OFFICE A
INCOMING TRUNKS FOR OFFICE B
OFFICE A PHYSICAL NUMBERS
OFFICE A THEORETICAL NUMBERS
OFFICE B PHYSICAL NUMBERS
OFFICE B THEORETICAL NUMBERS
DIRECTED IN MARKER BY EXTRA PULSING FROM ORIGINATING OFFICE

NOTE: TERMINATING OFFICE IS A CROSSBAR NO. 5 SYSTEM

PHYSICAL - THEORETICAL OPERATION OF INDIVIDUAL TRUNK GROUPS
INDICATIONS BY TRUNK GROUPS AND EXTRA PULSING

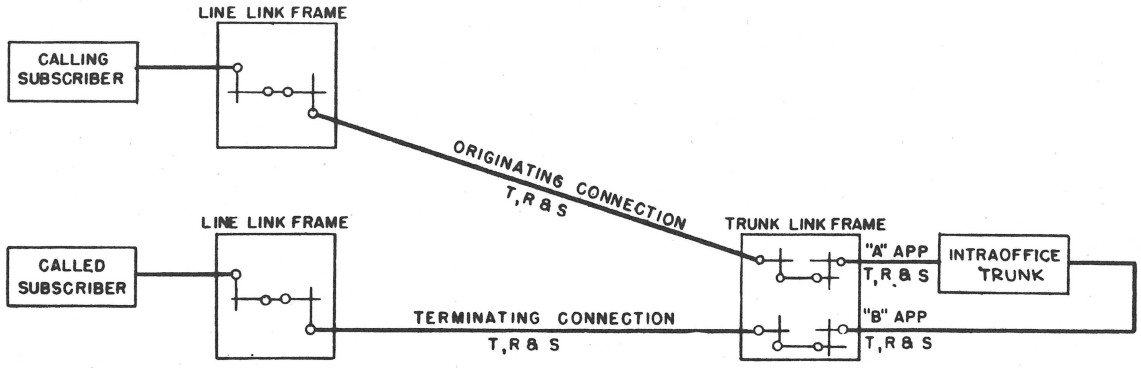
FIG. 5B-046


SUBSCRIBER STATION
MDF
100 JUNCTORS
100 JUNCTORS
100 JUNCTORS
TO OTHER SUBSCRIBER STATIONS
VARIOUS OTHER MISC. TRUNKS
V
H
CROSS CONNECT AS REQ. TO PROVIDE JUNCTOR DISTRIBUTION
100 JUNCTORS EACH TO OTHER LINE LINK FRAMES
* LINE LINK FRAME (290 TO 590 LINES)
JUNCTOR GROUPING FRAME (10 TRK LK.FR)
* TRUNK LINK FRAME (160 TRUNKS) CAPACITY
200 JUNCTORS EACH TO OTHER TRUNK LINK FRAMES
* AT LEAST ONE TRUNK LINK FRAME IS REQUIRED PER TWO LINE LINK FRAMES
TO HORIZONTAL LEVELS TRUNK LINK FRAMES
MISC. TRUNKS
MISC. TRKS.
TRUNKS TO DSA SWBD.
OUTGOING TRUNKS
INCOMING TRUNKS
RINGING CONTROL SWITCH
INTRAOFFICE TRUNKS
I.M.G. TRUNK
REVERTING RINGING TRUNKS
ORIGINATING REGISTERS
5 REG. PER FRAME
MDF
H
V
TO CABLE COND.
O G SENDER LINK FRAME (200 TRUNKS)
INC. REG. LINK FRAME (100 TRUNKS)
OUTGOING SENDER
5 SENDERS PER FRAME
INCOMING REGISTER
5 REG. PER FRAME
INTER. MARKER GROUP SENDER
INC. REG. MKR. CONN. IN OTHER MKR. GROUP
TO ORIG. REG. INC. REG. OG SENDER
SUBSCRIBER NUMBER GROUP FRAME (ONE PER 1000 NUMBERS)
NUMBER GROUP CONN NOTE 2
3 CONN. PER FRAME
LINE LINK MKR. CONN. NOTE 1
4 CONN. PER FRAME
LINE LINK CONN. NOTE 2
4 CONN. PER FRAME
TRUNK LINK CONN. NOTE 2
1 CONN. PER FRAME
ORG. REG. MKR. CONN. NOTE 1
4 CONN. PER FRAME
OG SENDER CONN. NOTE 2
2 CONN. PER FRAME
INC. REG. MKR. CONN. NOTE 2
4 CONN. PER FRAME
MASTER TEST CONN.
1 CONN. PER FRAME
MASTER TEST CONTROL, AUTOMATIC MONITOR & TRUNK TEST
1 TEST CKT. PER FRAME
TROUBLE RECORDER
1 RECORDER PER FRAME
MARKER
Note 1 - Provided for Combined or Dial Tone Markers only.
Note 2 - Provided for Combined or Completing Markers only.

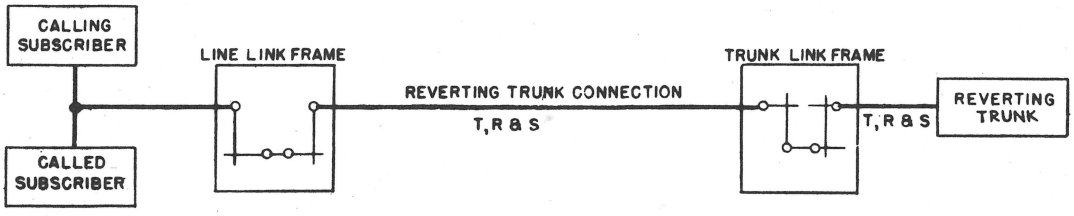
EQUIPMENT SCHEMATIC OF A NO. 5 CROSSBAR OFFICE

(#5 CROSSBAR)

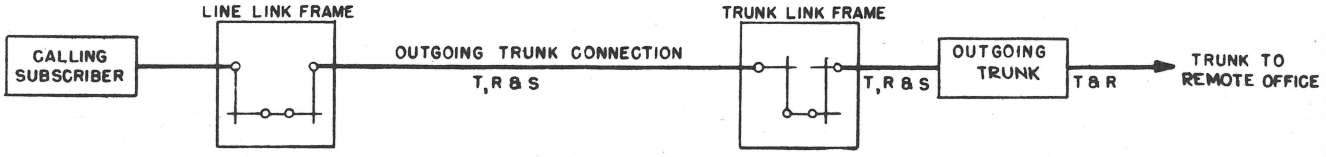
FIG. 5B-050



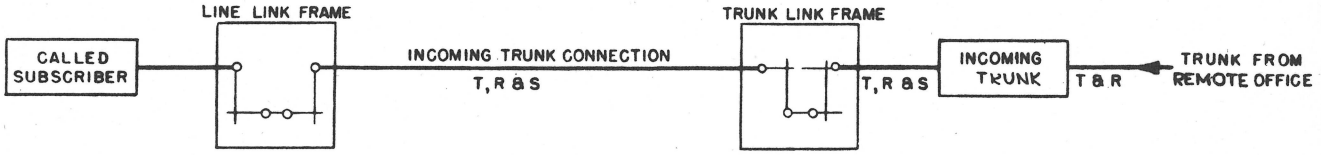
ESTABLISHED INTRAOFFICE TRUNK CONNECTION



REVERTING TRUNK CONNECTION



OUTGOING TRUNK CONNECTION

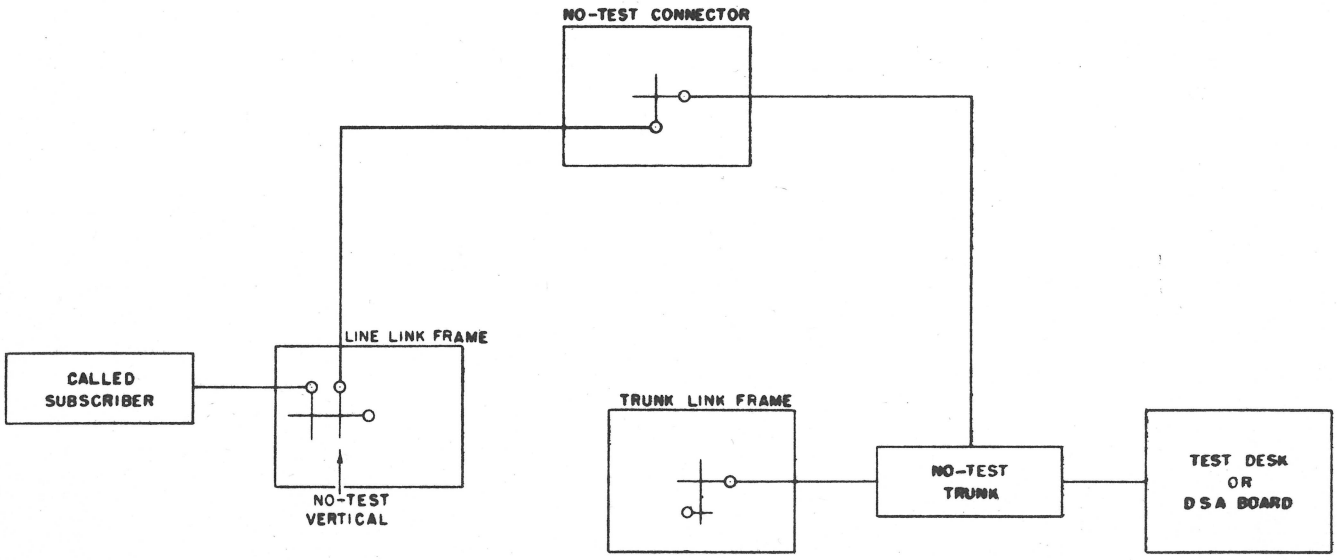


INCOMING TRUNK CONNECTION

ESTABLISHED DIALING CONNECTION

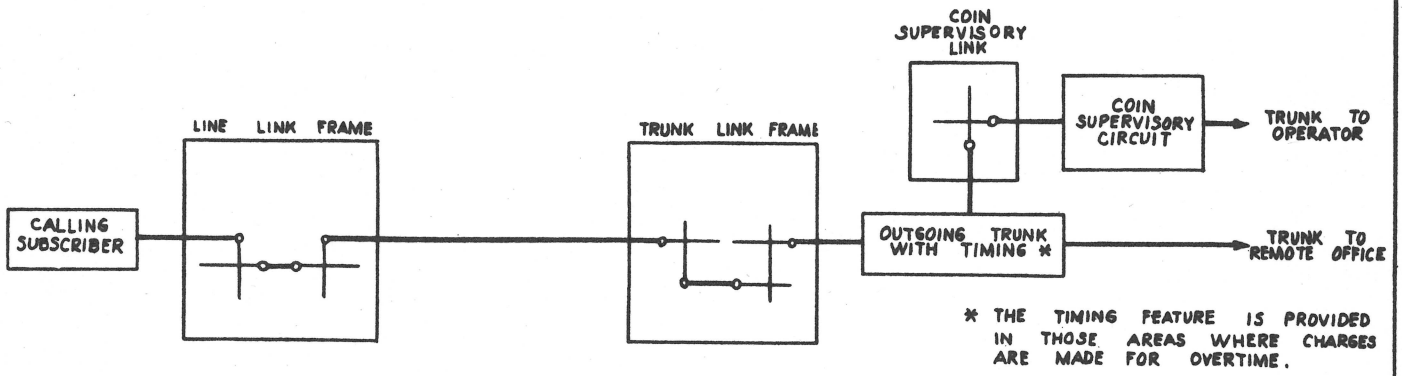
CONNECTIONS WITHIN A NO. 5 CROSSBAR CENTRAL OFFICE

FIG. 5B-051

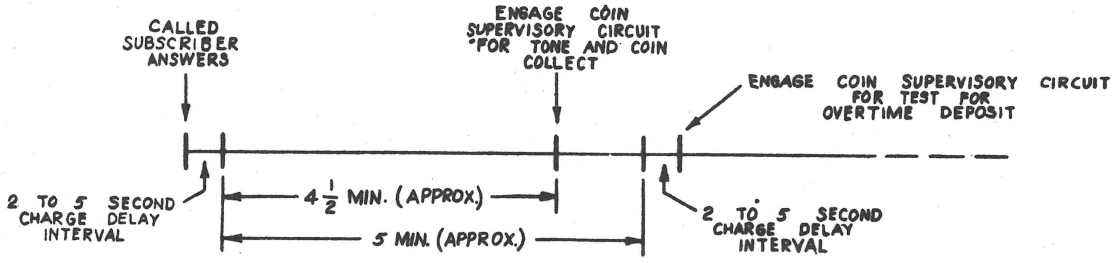


NO-TEST CALL ESTABLISHED THROUGH NO-TEST CONNECTOR

FIG.5B-052


COIN SUPERVISORY LINK
COIN SUPERVISORY CIRCUIT
TRUNK TO OPERATOR
LINE LINK FRAME
TRUNK LINK FRAME
CALLING SUBSCRIBER
OUTGOING TRUNK WITH TIMING *
TRUNK TO REMOTE OFFICE
* THE TIMING FEATURE IS PROVIDED IN THOSE AREAS WHERE CHARGES ARE MADE FOR OVERTIME.

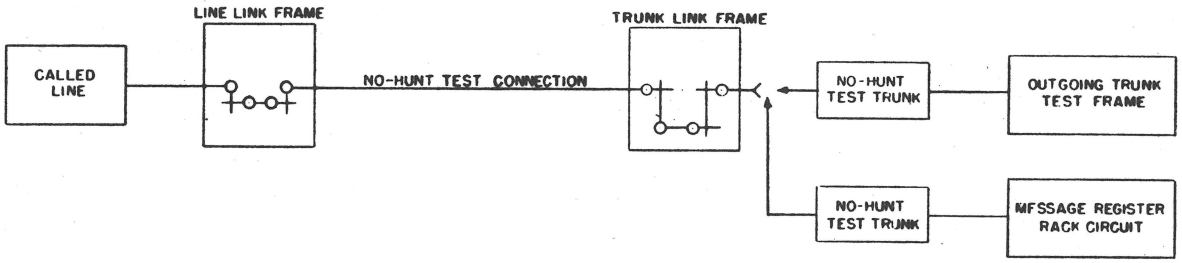
ASSOCIATION OF COIN TRUNK AND COIN SUPERVISORY LINK


CALLED SUBSCRIBER ANSWERS
ENGAGE COIN SUPERVISORY CIRCUIT FOR TONE AND COIN COLLECT
ENGAGE COIN SUPERVISORY CIRCUIT FOR TEST FOR OVERTIME DEPOSIT
2 TO 5 SECOND CHARGE DELAY INTERVAL
4 1/2 MIN. (APPROX.)
5 MIN. (APPROX.)
2 TO 5 SECOND CHARGE DELAY INTERVAL

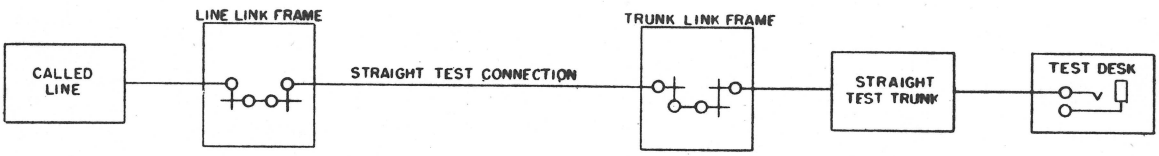
INTERVALS FOR COIN OPERATION WITH OVERTIME

COIN TRUNK CONNECTION TO COIN SUPERVISORY LINK

FIG. 5B-053



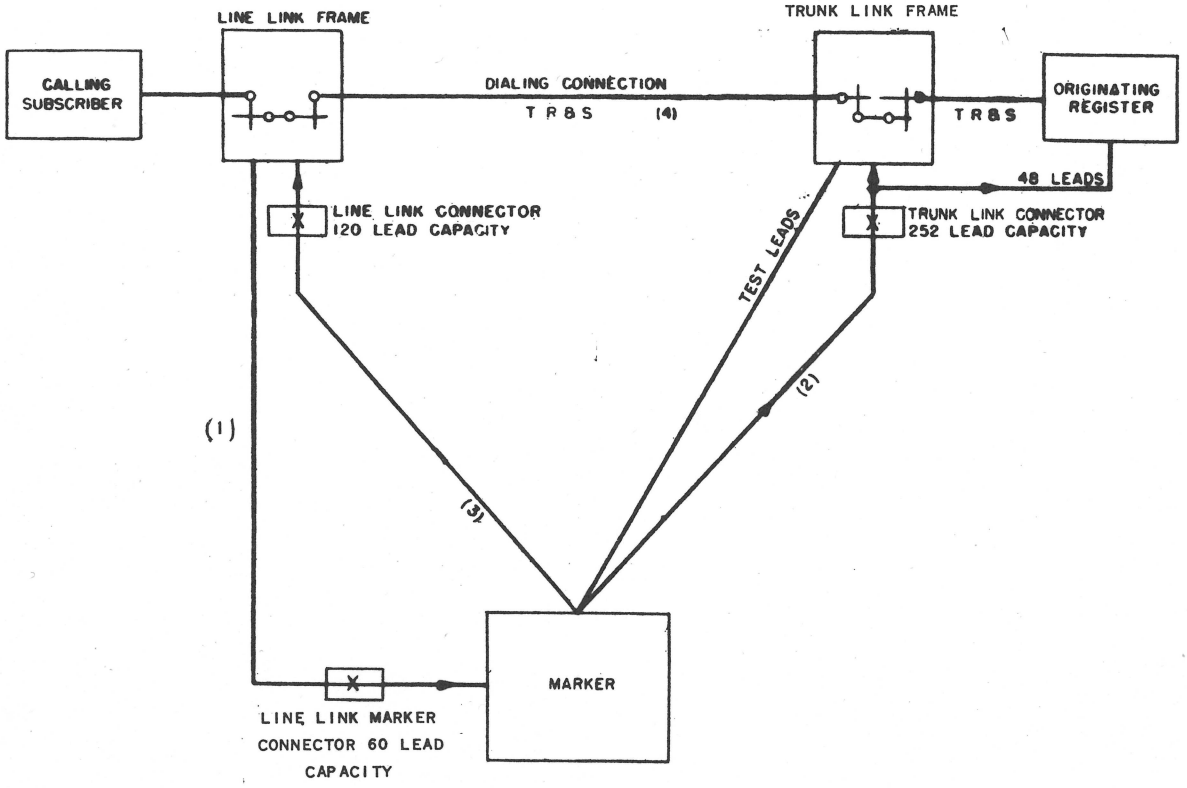
ESTABLISHED NO-HUNT TEST CONNECTION



ESTABLISHED STRAIGHT TEST CONNECTION

TEST CALL CONNECTIONS

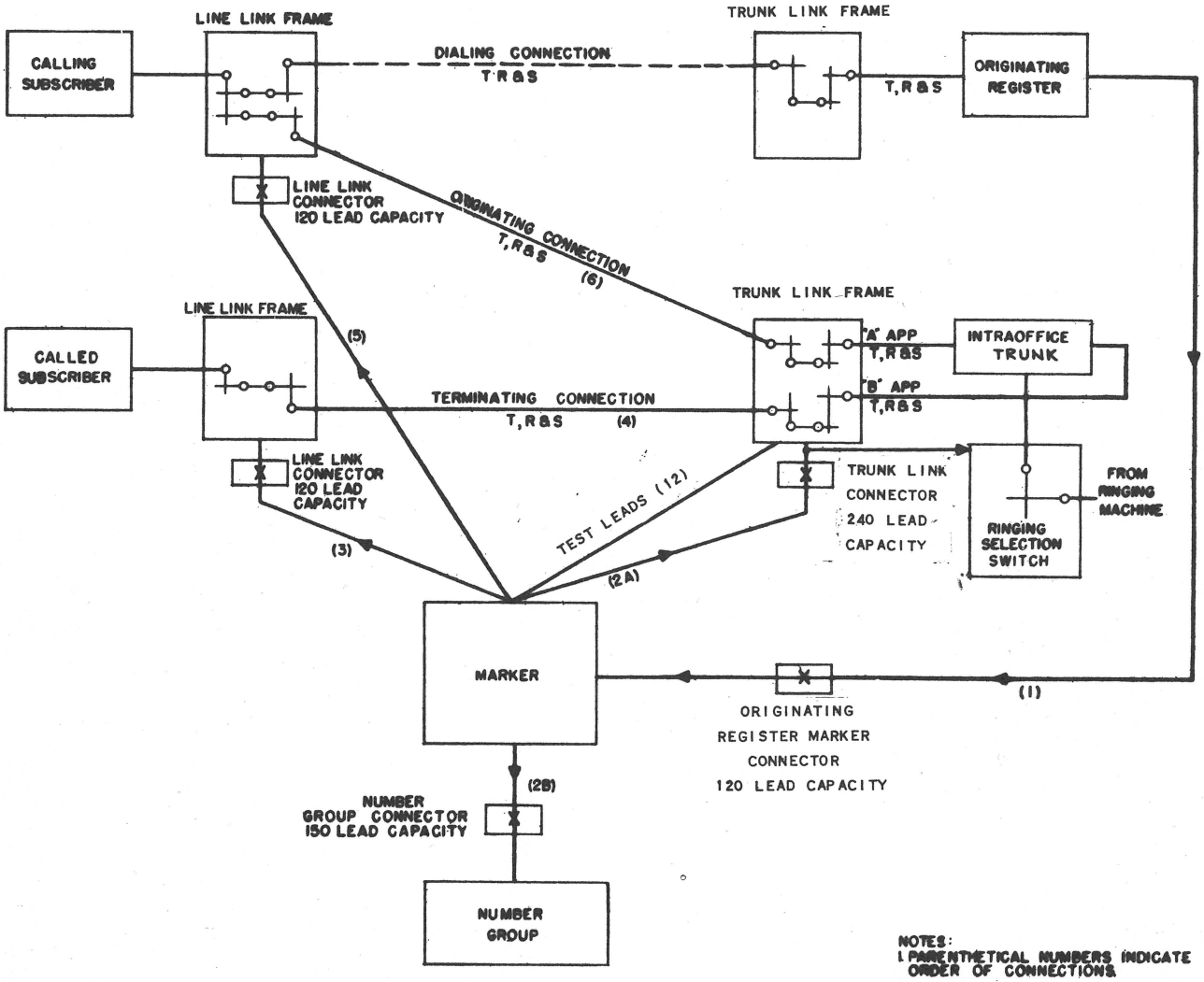
FIG.5B-054



NOTES:
1. PARENTHETICAL NUMBERS INDICATE ORDER OF CONNECTIONS
2. ARROWS INDICATE DIRECTION OF CONNECTIONS

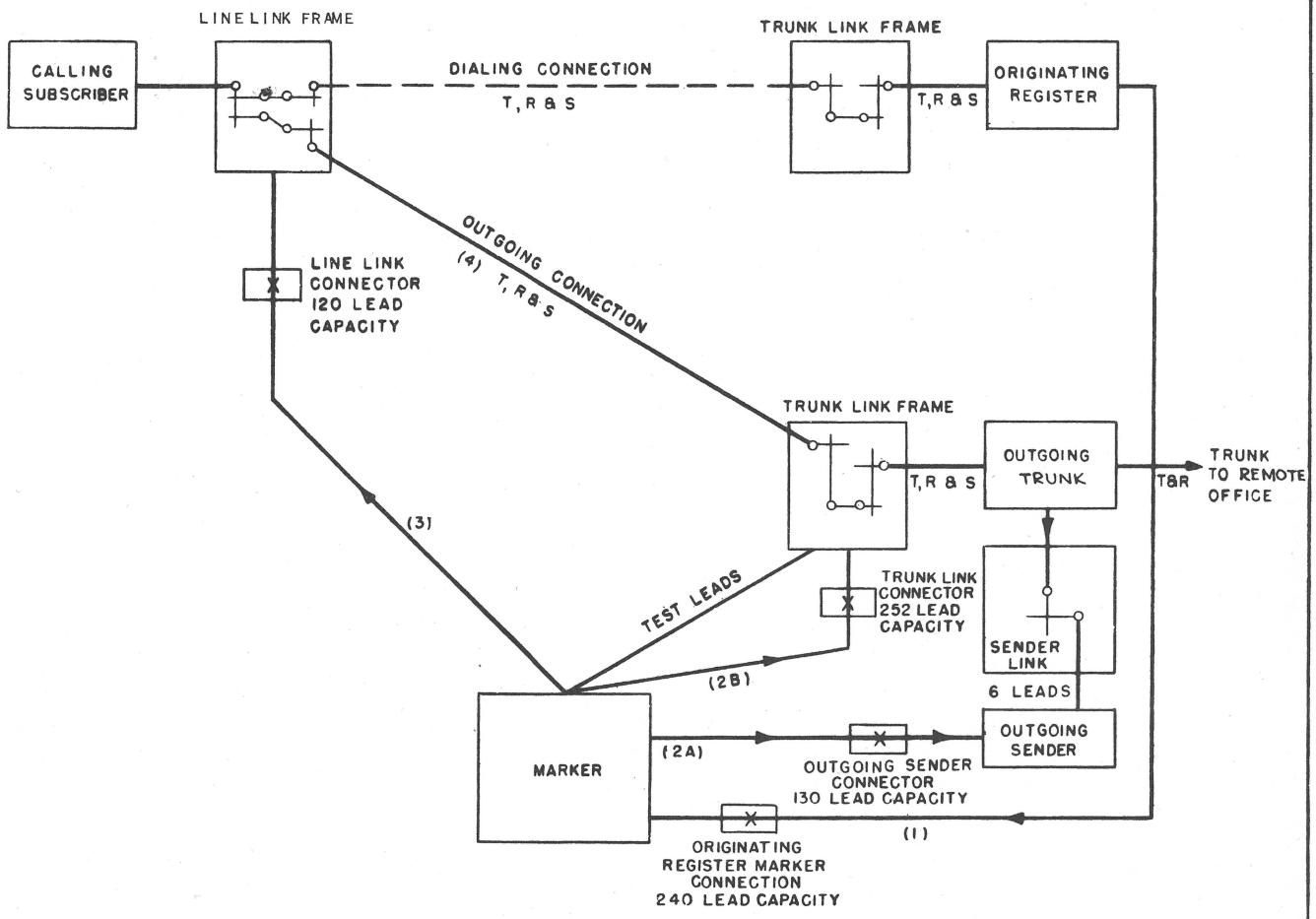
ESTABLISHING DIALING CONNECTION

FIG.5B-055



ESTABLISHING INTRAOFFICE TRUNK CONNECTION

FIG. 5B-056

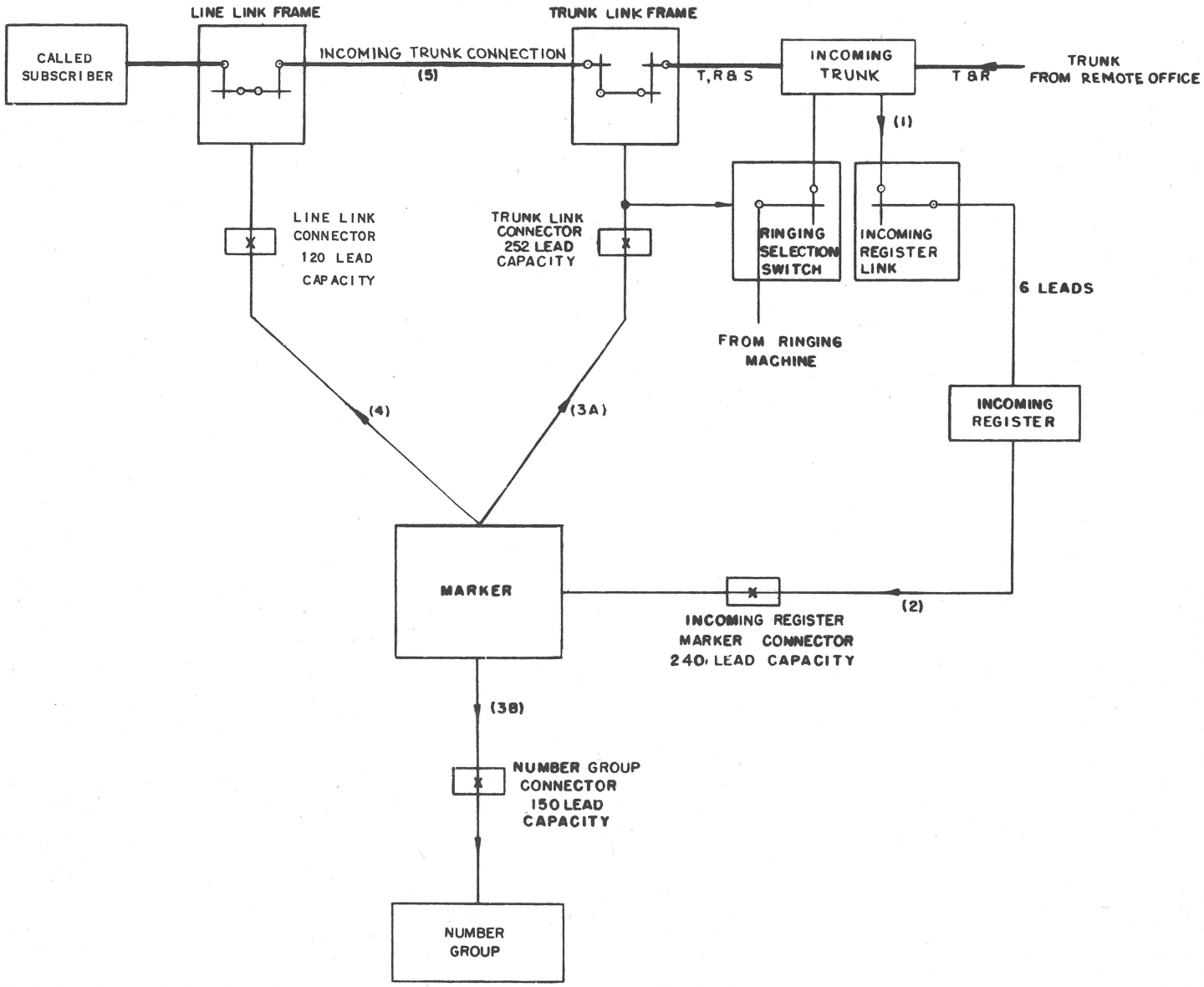


NOTES:

1. PARENTHETICAL NUMBERS INDICATE ORDER OF CONNECTIONS.
2. ARROWS INDICATE DIRECTION OF CONNECTIONS.

ESTABLISHING OUTGOING TRUNK CONNECTION

FIG. 5B-057

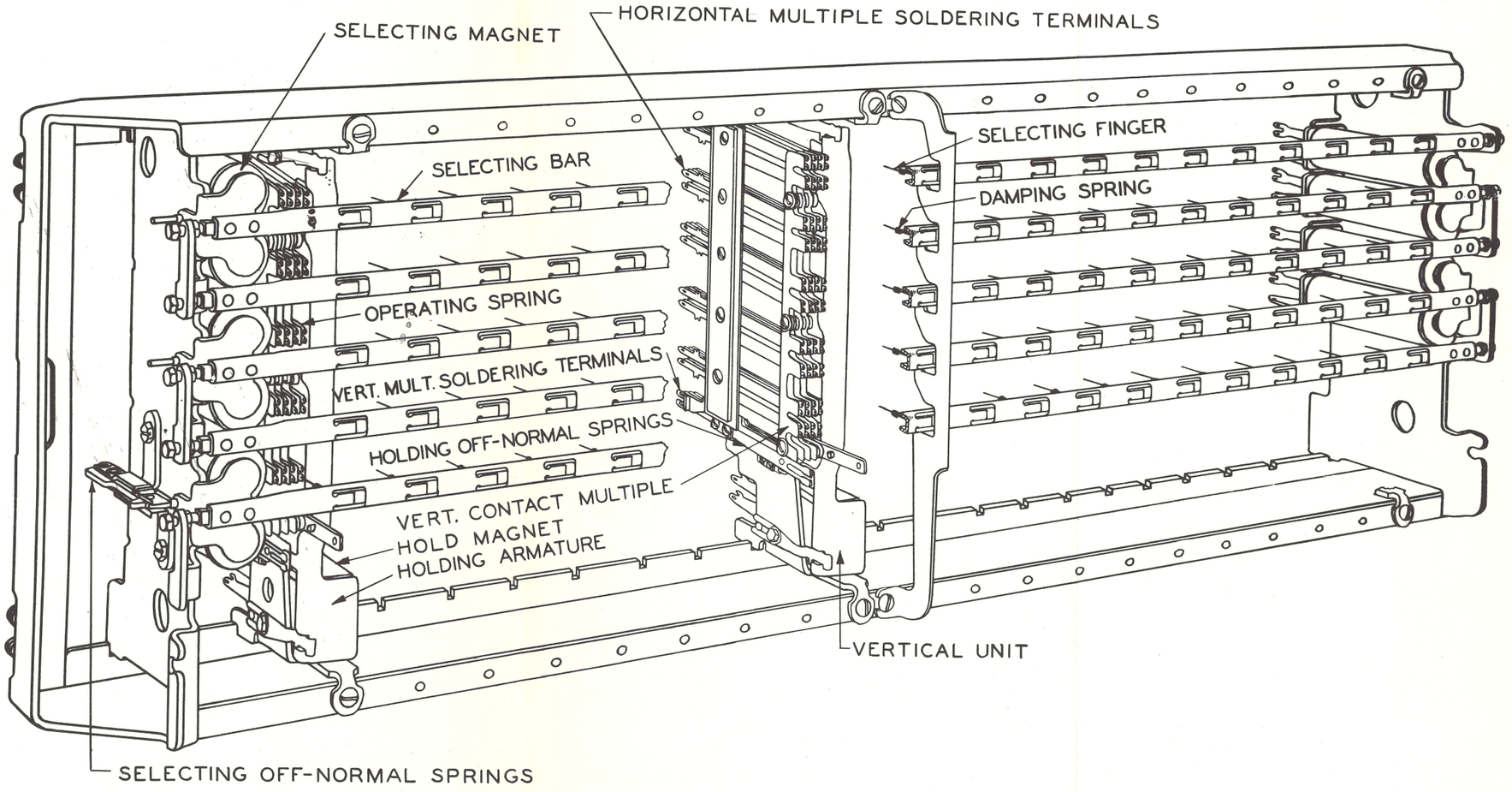


NOTES:

1. PARENTHETICAL NUMBERS INDICATE ORDER OF CONNECTIONS
2. ARROWS INDICATE DIRECTION OF CONNECTIONS

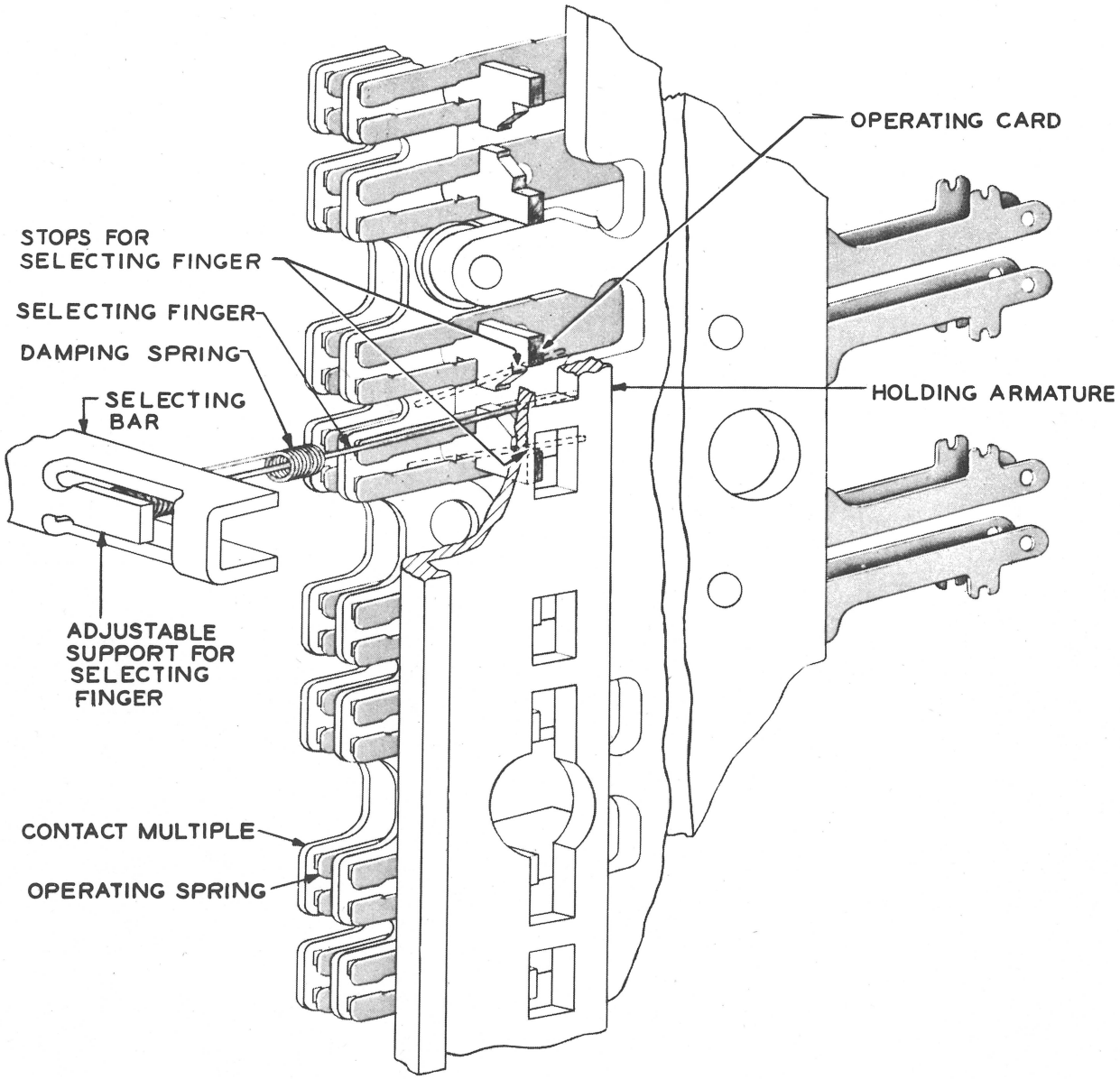
ESTABLISHING INCOMING TRUNK CONNECTION

FIG. 5B-058



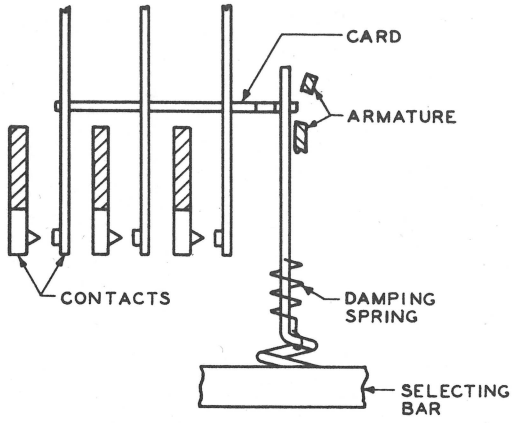
PARTIAL PERSPECTIVE VIEW OF 20-VERTICAL UNIT CROSSBAR SWITCH (200 POINT)

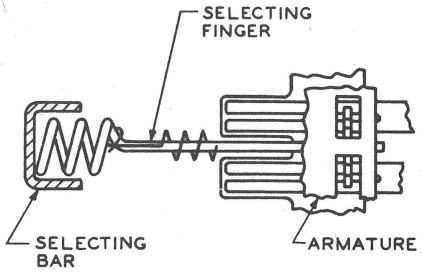
FIG. 5B-100



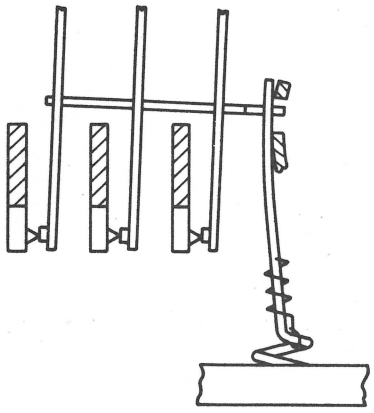
PARTIAL PERSPECTIVE VIEW OF THE
SELECTION ELEMENTS OF A CROSSBAR SWITCH
VERTICAL UNIT

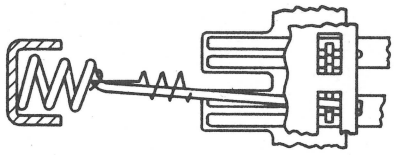
FIG.5B-101



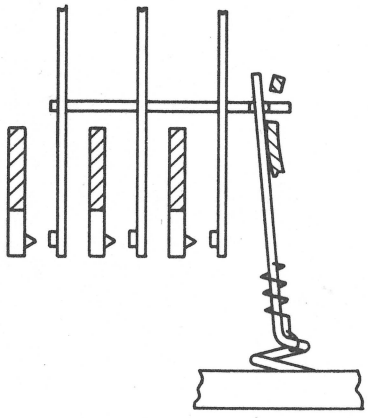


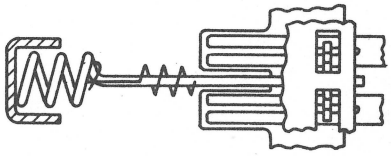
VERTICAL UNIT NORMAL





LOWER CROSS POINT OF A PAIR OPERATED

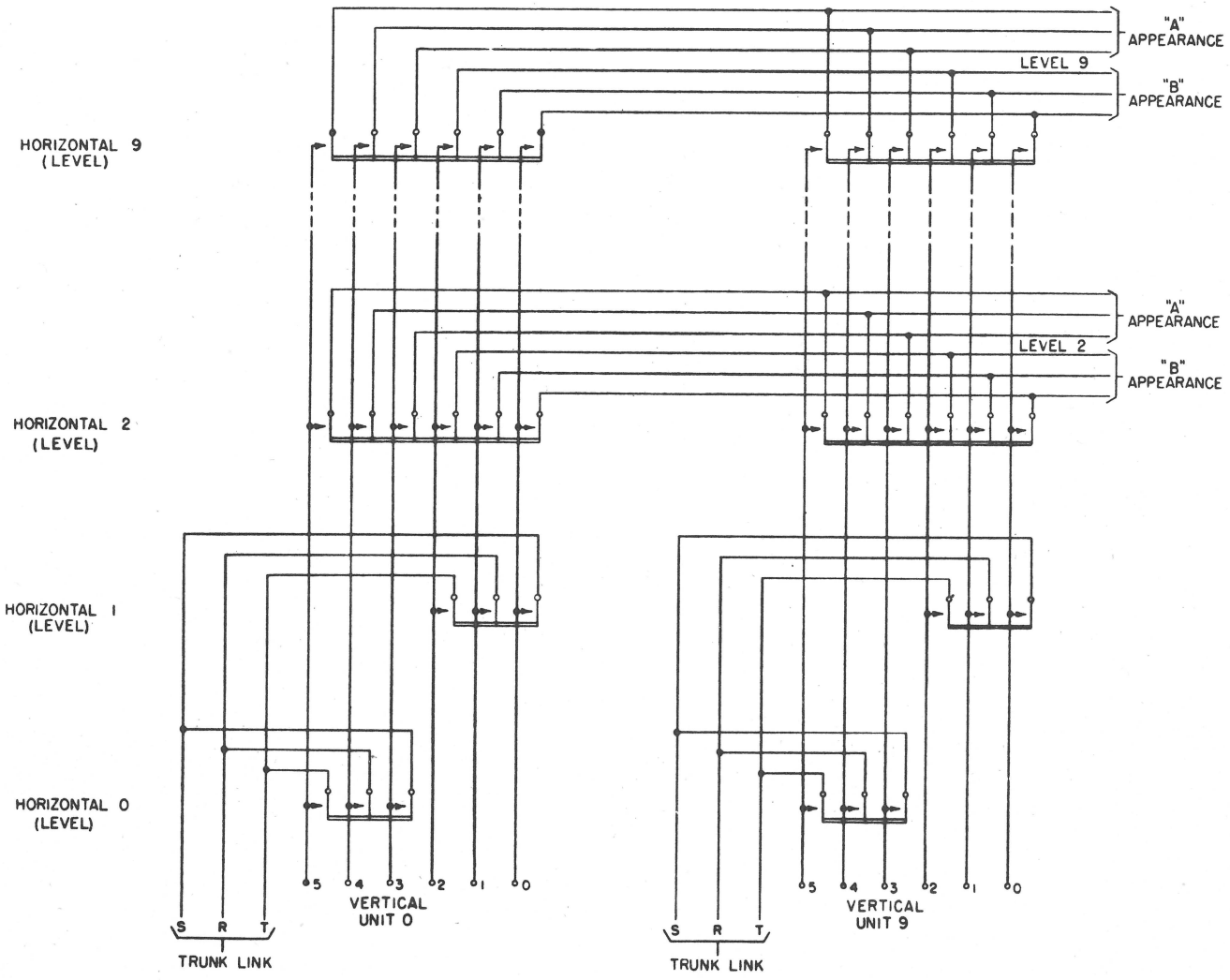




LOWER CROSS POINT NORMAL, ARMATURE OPERATED

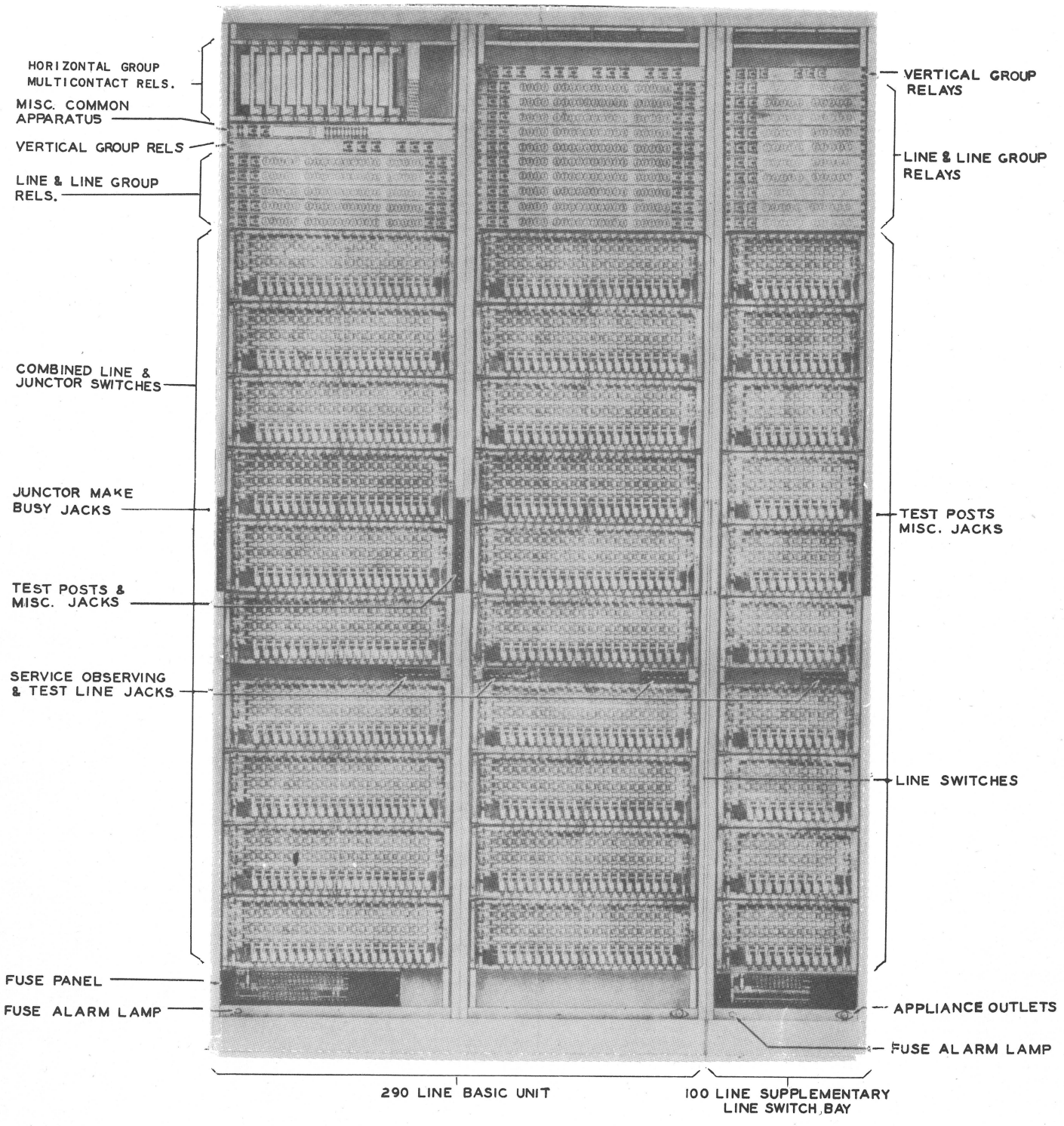
CROSSBAR SWITCH
SELECTING MECHANISM

FIG. 5B-102



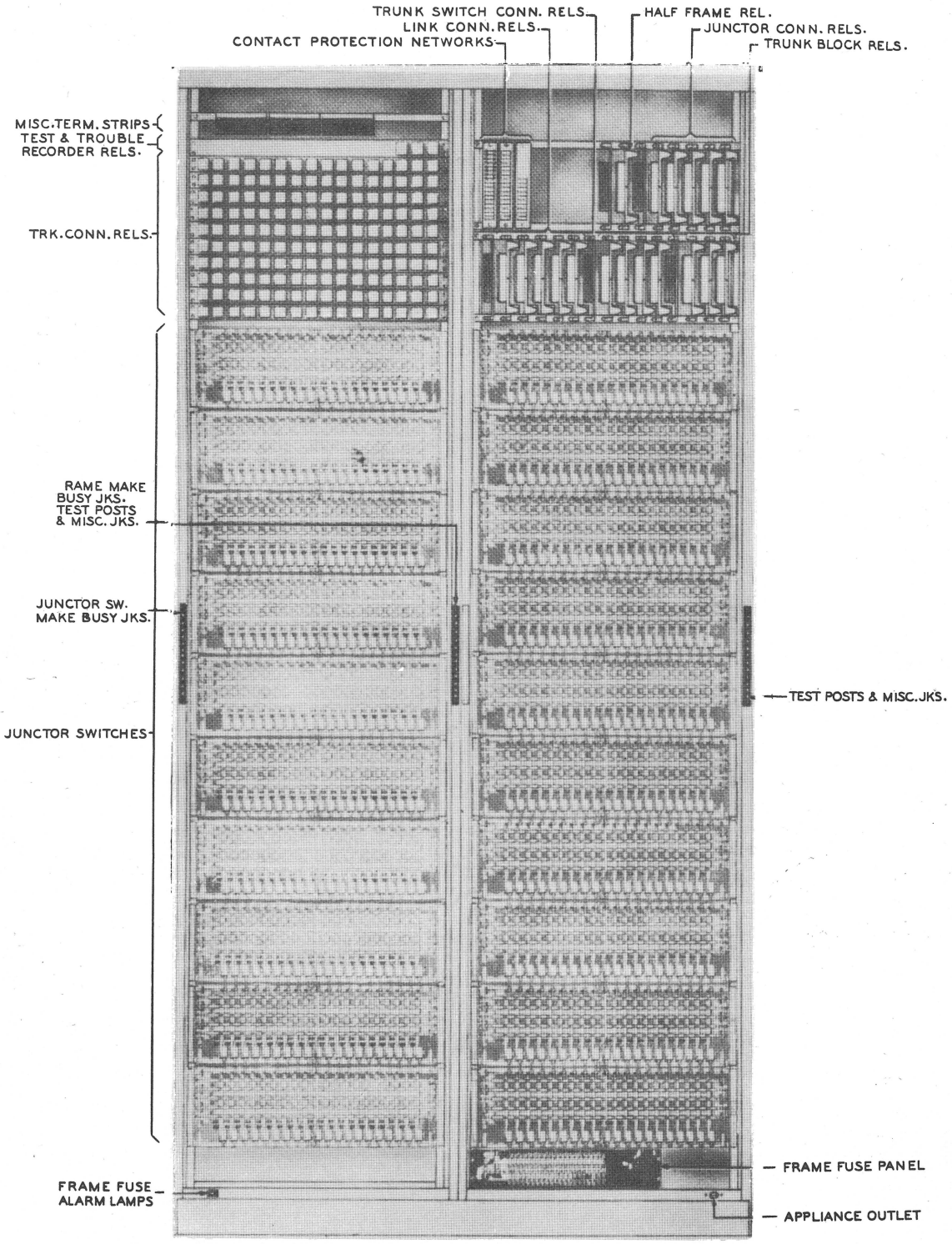
SWITCH ARRANGED FOR 16 TRUNK APPEARANCES

FIG.5B-103



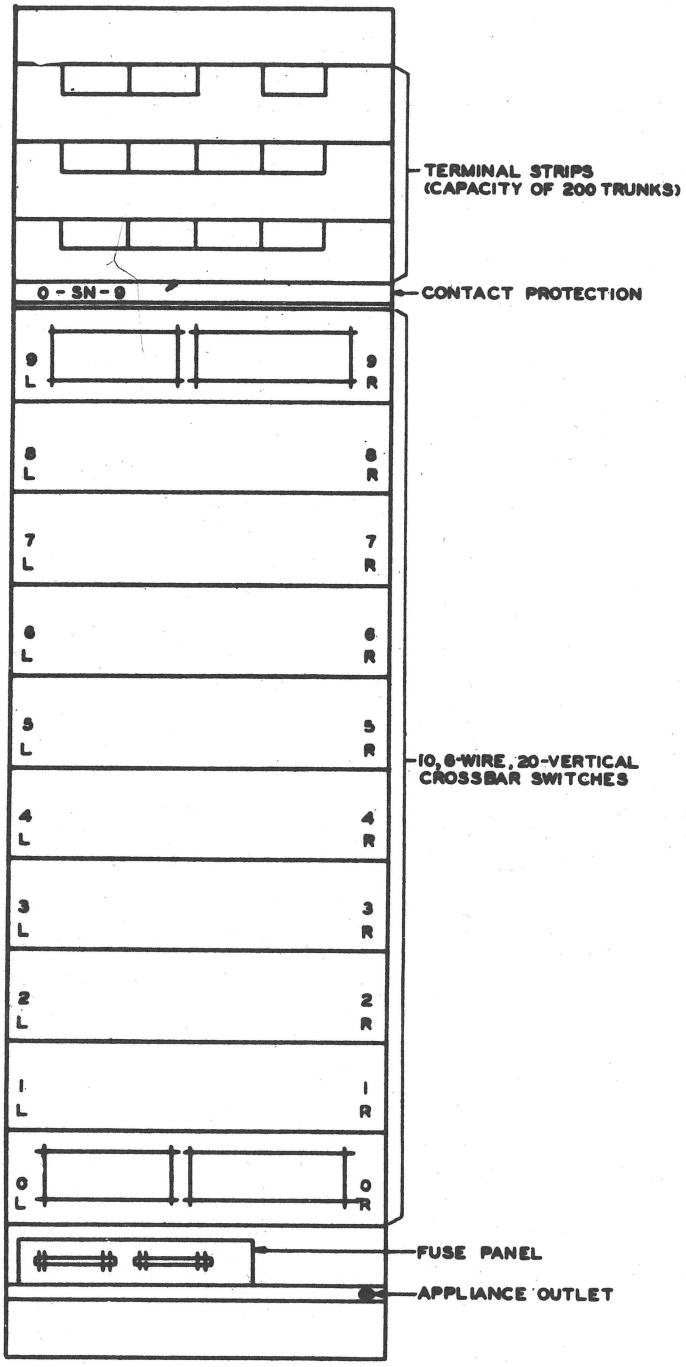
LINE LINK FRAME - FRONT VIEW

FIG. 5B-110



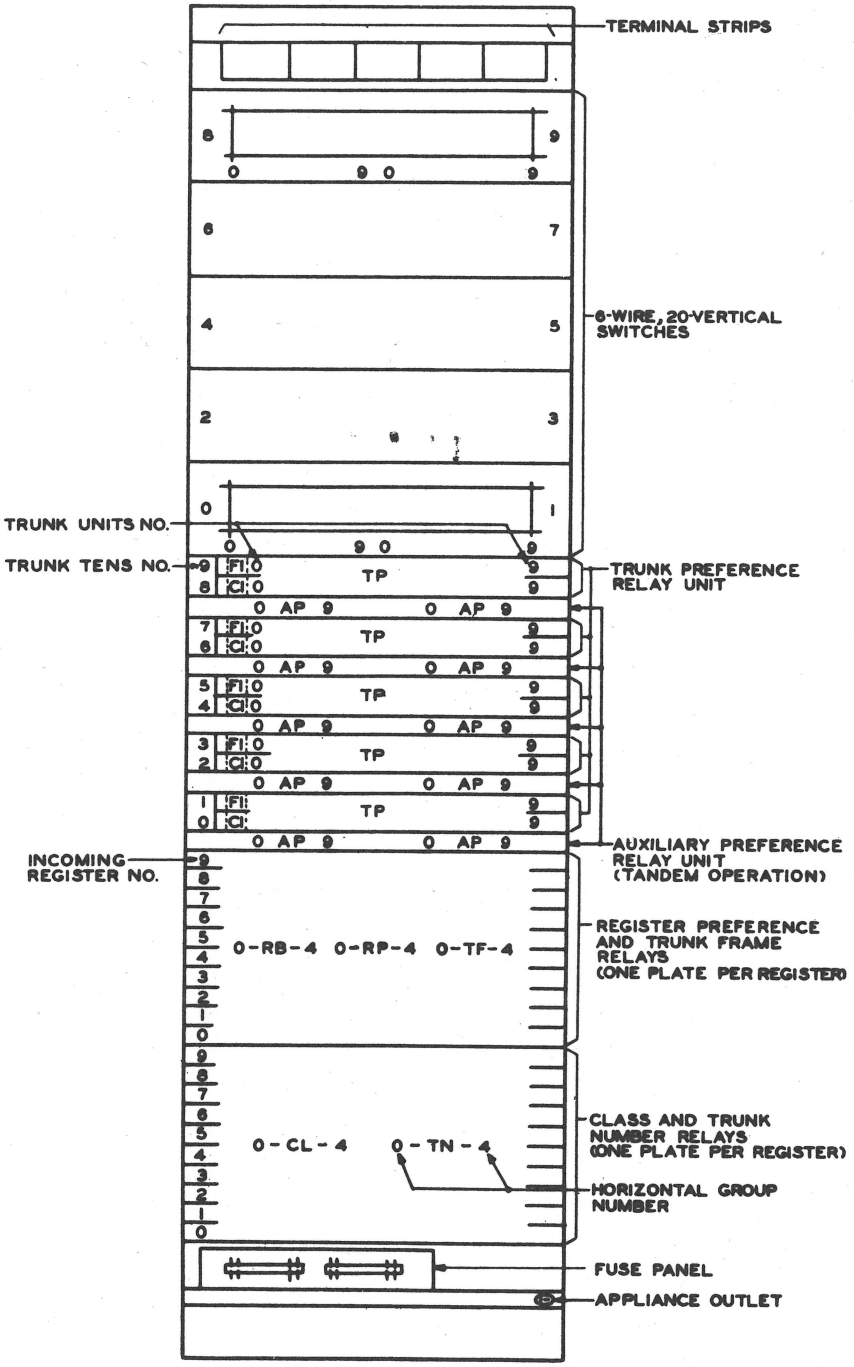
TRUNK LINK FRAME

FIG. 5B-111



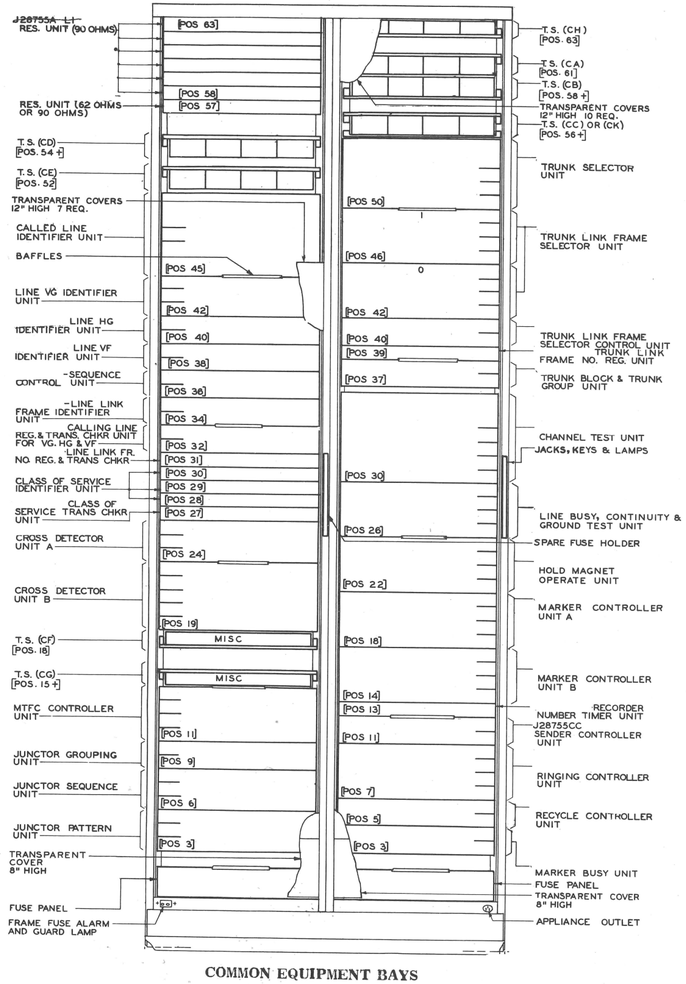
OUTGOING SENDER LINK FRAME

FIG. 5B-112

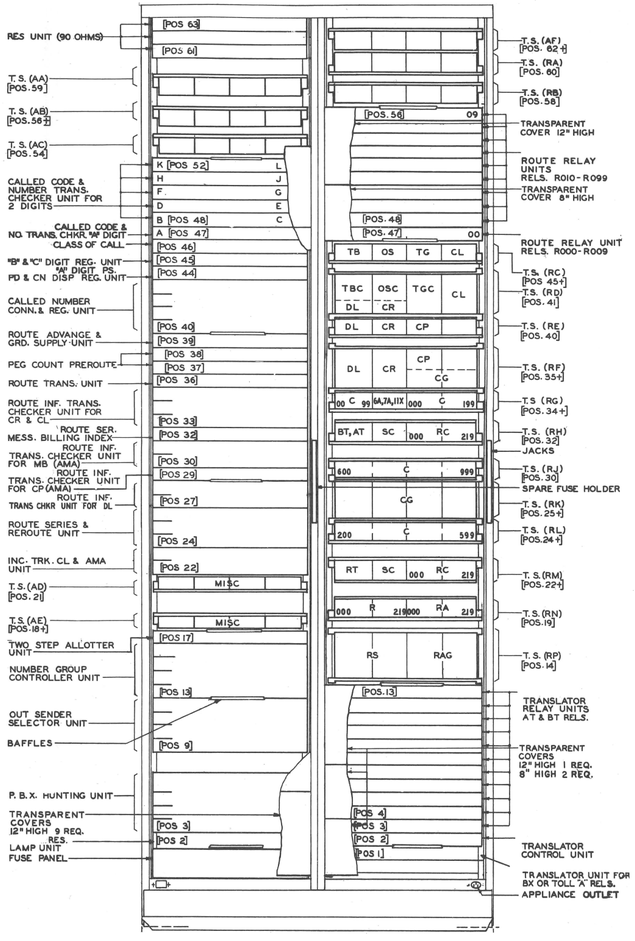


INCOMING REGISTER LINK FRAME

FIG. 5B-113

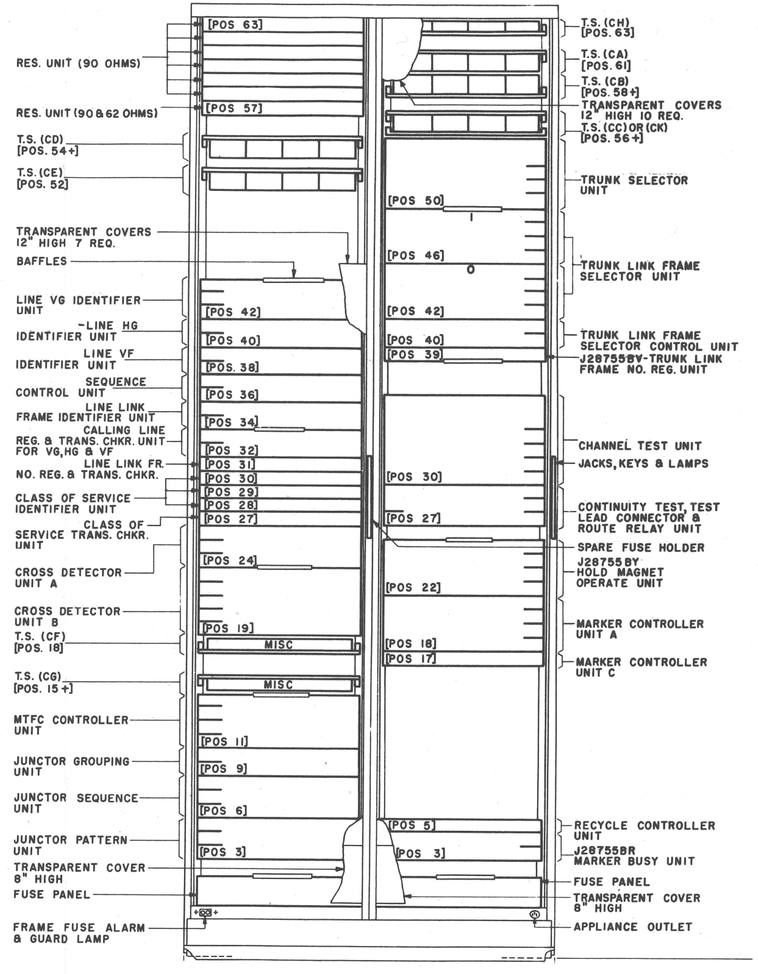


COMMON EQUIPMENT BAYS



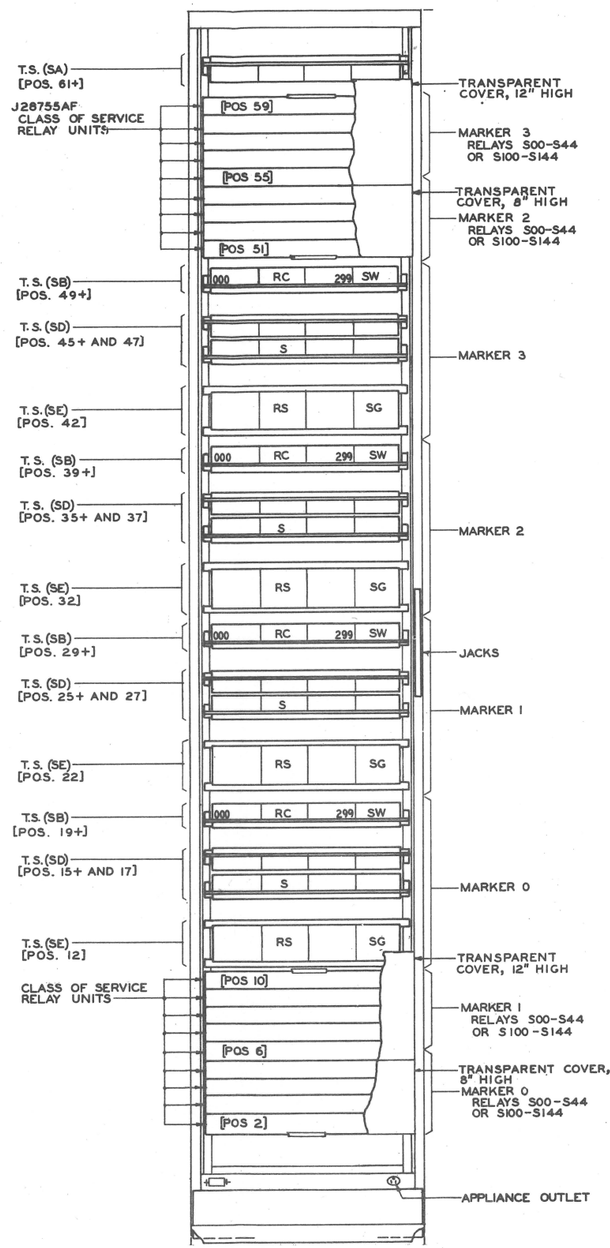
TRANSLATOR AND ROUTE RELAY BAYS

COMBINED OR COMPLETING MARKER FRAME



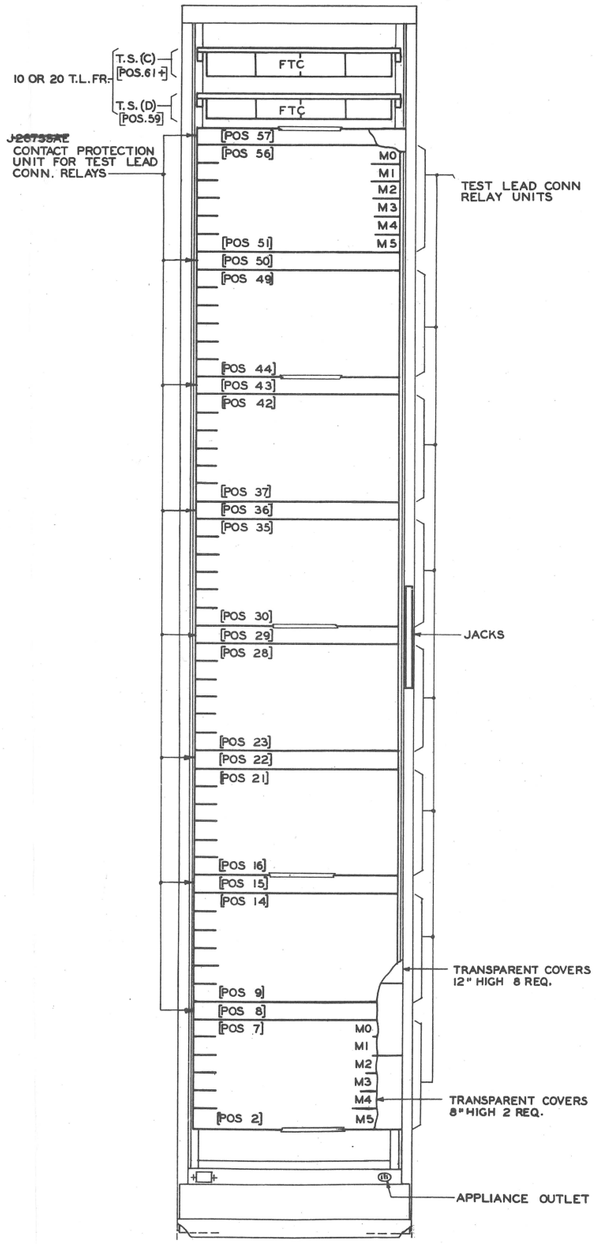
DIAL TONE MARKER FRAME

FIG. 5B-120



CLASS-OF-SERVICE BAY

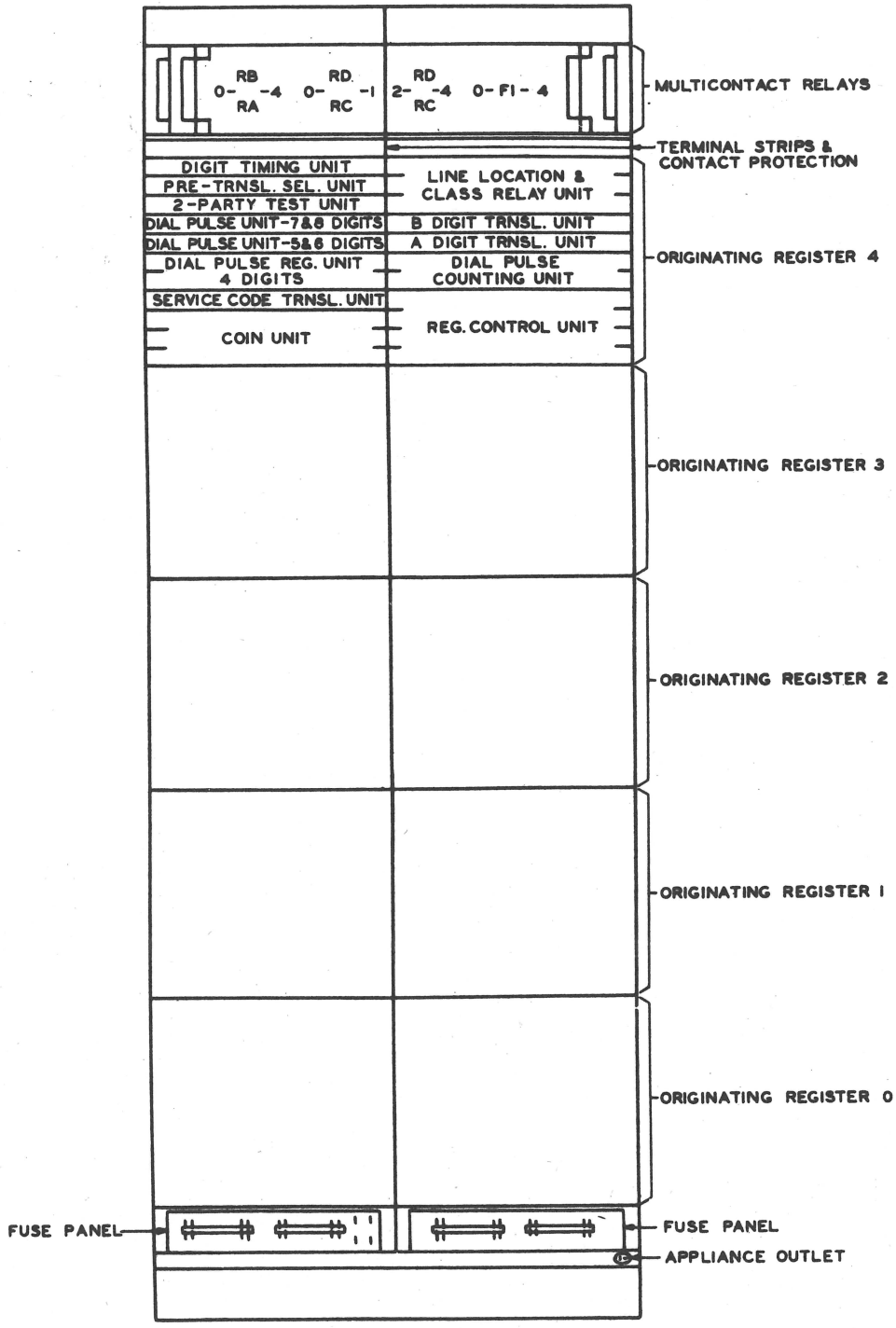
(One per 4 Markers)



TRUNK FRAME TEST LEAD CONNECTOR BAY

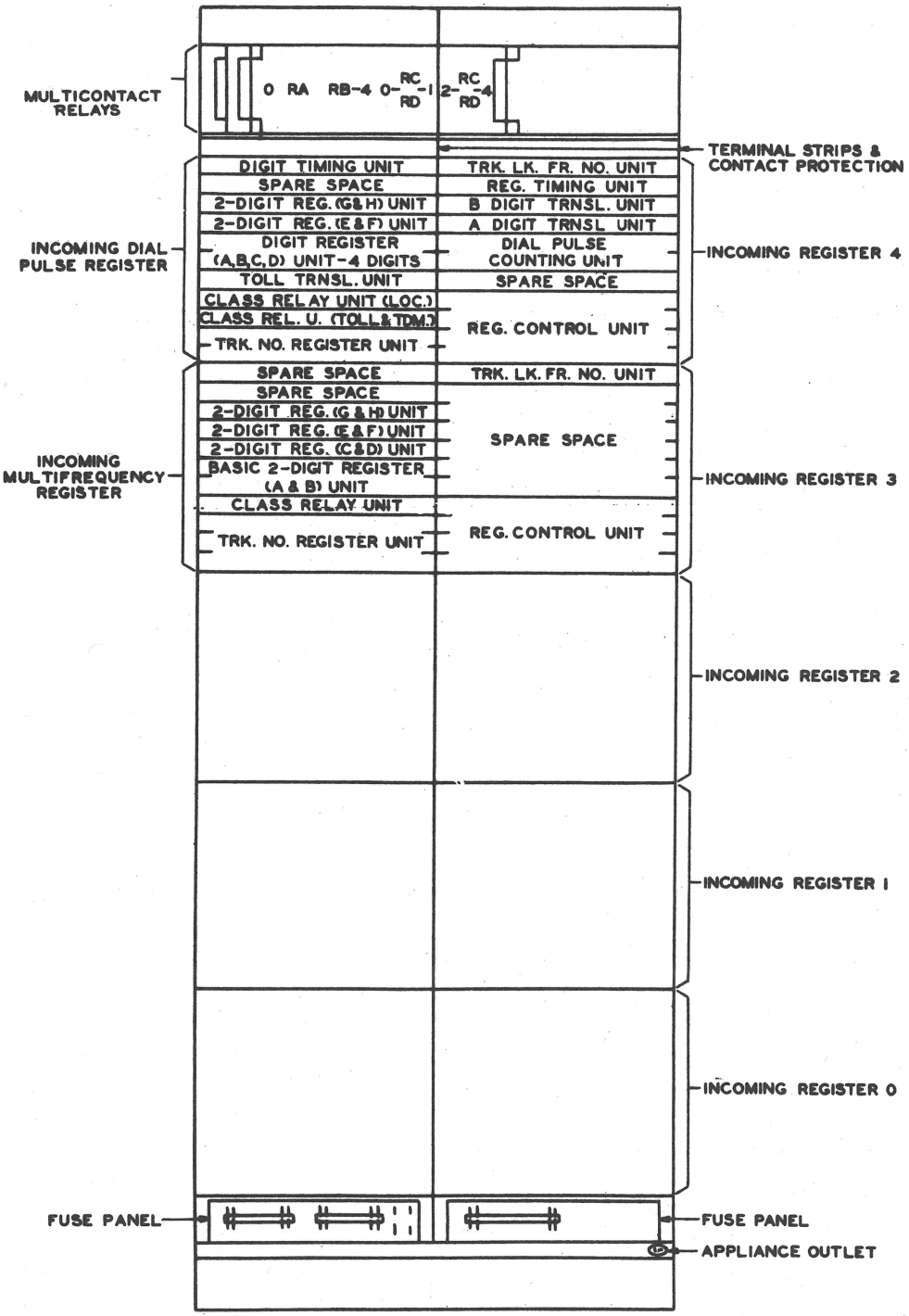
(Arrangement for 6 Markers, 80 Routes)

FIG.5B-121



DIAL PULSE ORIGINATING REGISTER FRAME

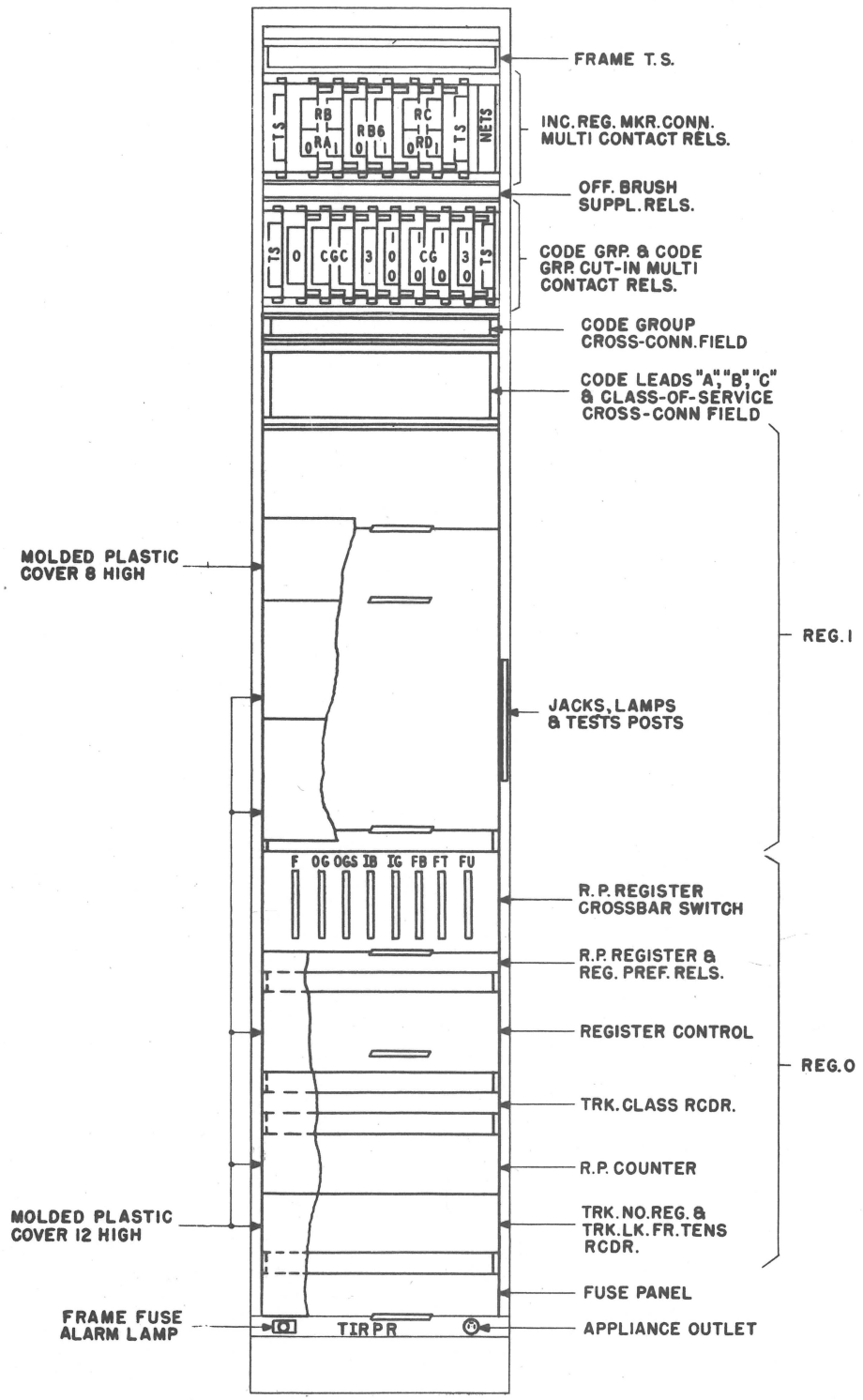
FIG.5B-130



NOTE:
REGISTERS ON THIS FRAME MAY BE EITHER DIAL PULSE OR MULTIFREQUENCY TYPE OR ANY COMBINATION OF THE TWO TYPES.

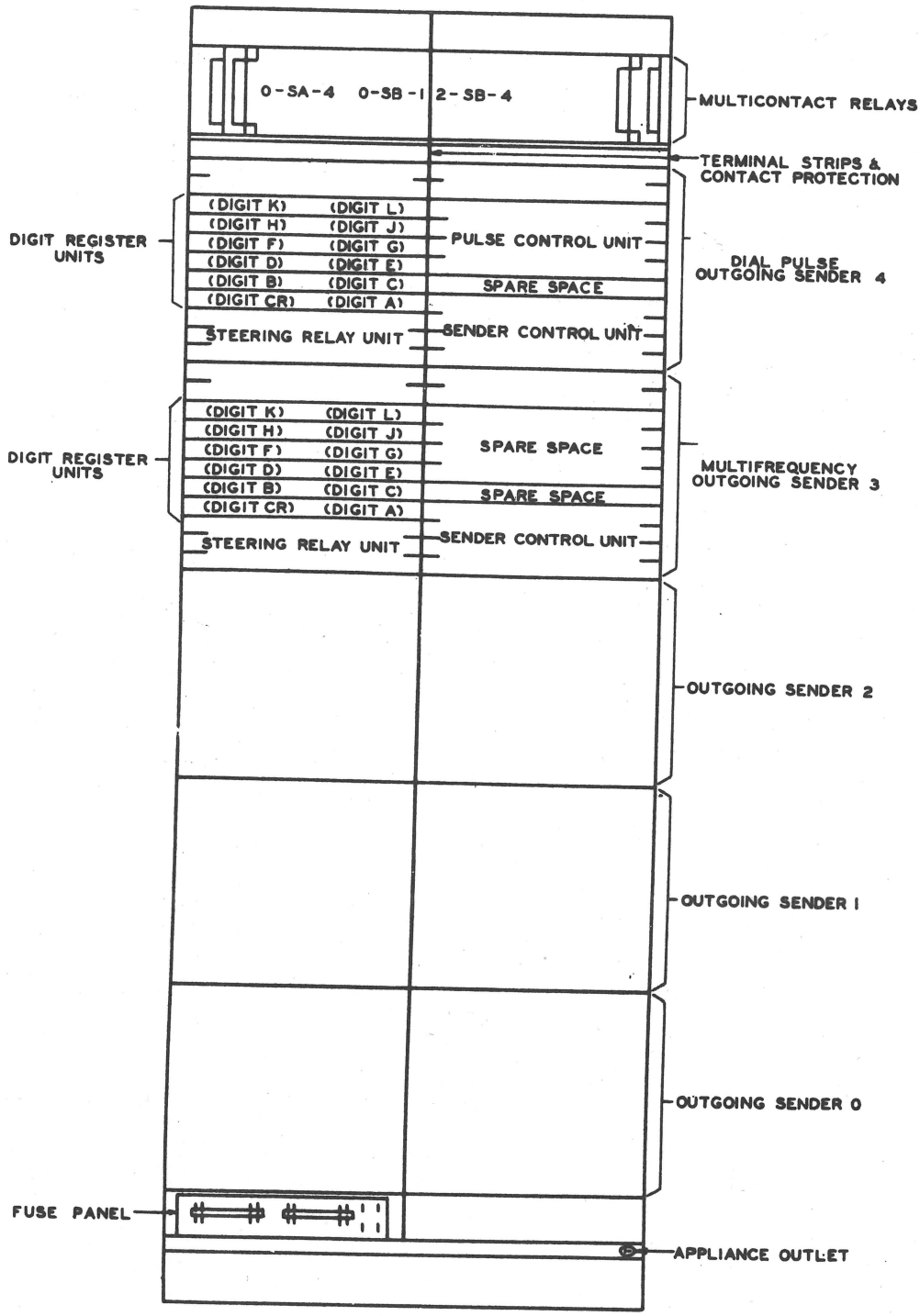
DIAL PULSE OR MULTIFREQUENCY INCOMING REGISTER FRAME

FIG. 5B-131


FRAME T.S.
INC. REG. MKR. CONN. MULTI CONTACT RELS.
OFF. BRUSH SUPPL. RELS.
CODE GRP. & CODE GRP. CUT-IN MULTI CONTACT RELS.
CODE GROUP CROSS-CONN. FIELD
CODE LEADS "A", "B", "C" & CLASS-OF-SERVICE CROSS-CONN FIELD
MOLDED PLASTIC COVER 8 HIGH
REG. I
JACKS, LAMPS & TESTS POSTS
F OG OGS IB IG FB FT FU
R.P. REGISTER CROSSBAR SWITCH
R.P. REGISTER & REG. PREF. RELS.
REGISTER CONTROL
REG. O
TRK. CLASS RCDR.
R.P. COUNTER
MOLDED PLASTIC COVER 12 HIGH
TRK. NO. REG. & TRK. LK. FR. TENS RCDR.
FUSE PANEL
FRAME FUSE ALARM LAMP
TIRPR
APPLIANCE OUTLET

TANDEM INCOMING REVERTIVE PULSE REGISTER FRAME

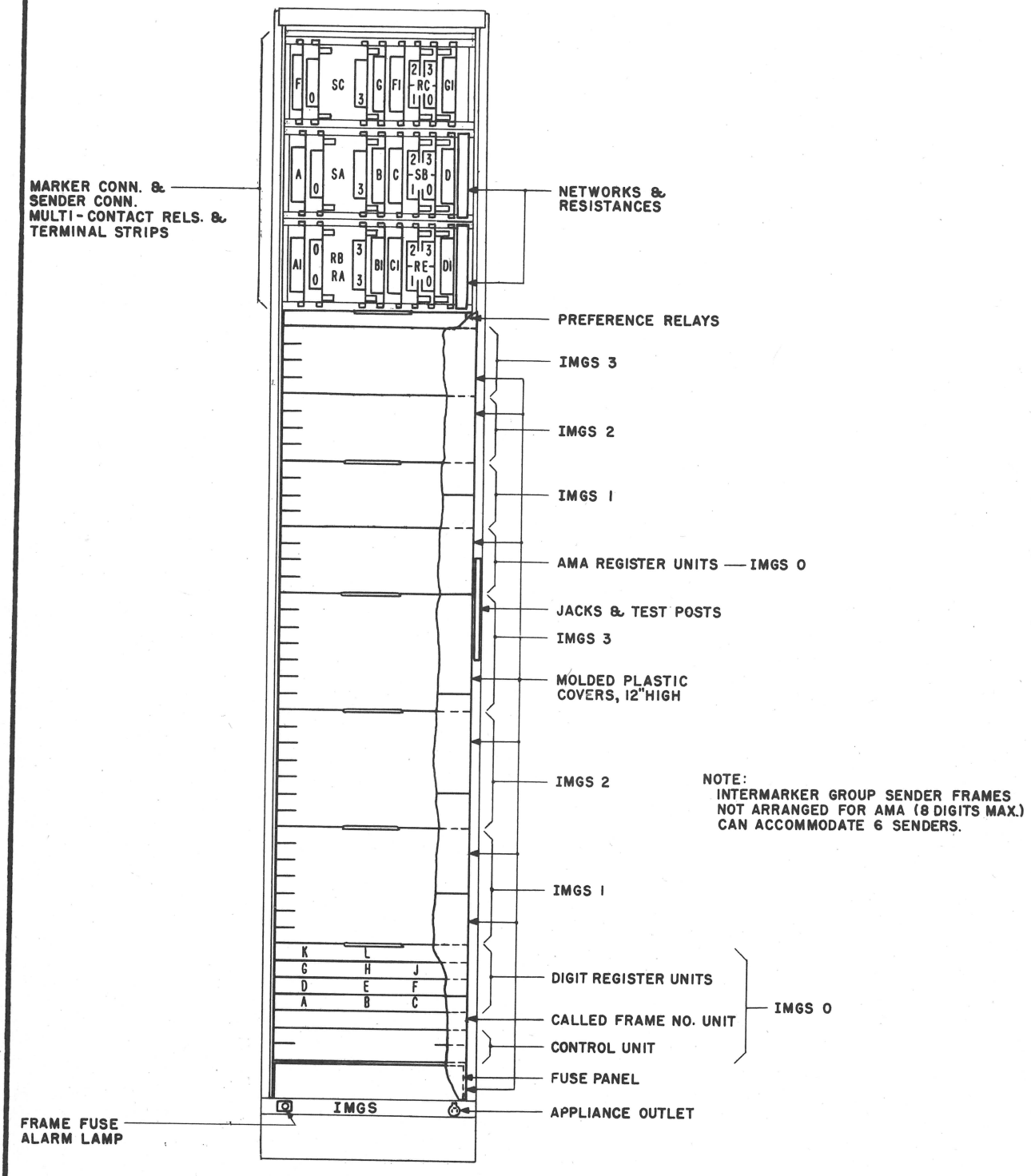
FIG. 5B-132



NOTE:
SENDERS ON THIS FRAME MAY BE EITHER DIAL PULSE OR MULTIFREQUENCY TYPE OR ANY COMBINATION OF THE TWO TYPES.

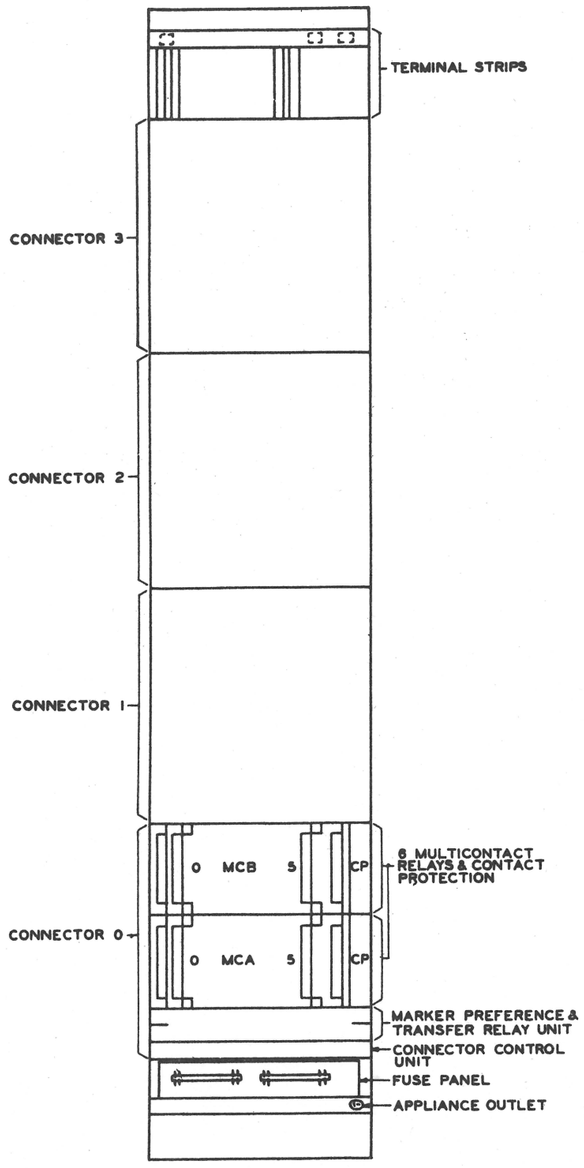
DIAL PULSE OR MULTIFREQUENCY OUTGOING SENDER FRAME

FIG. 5B-140

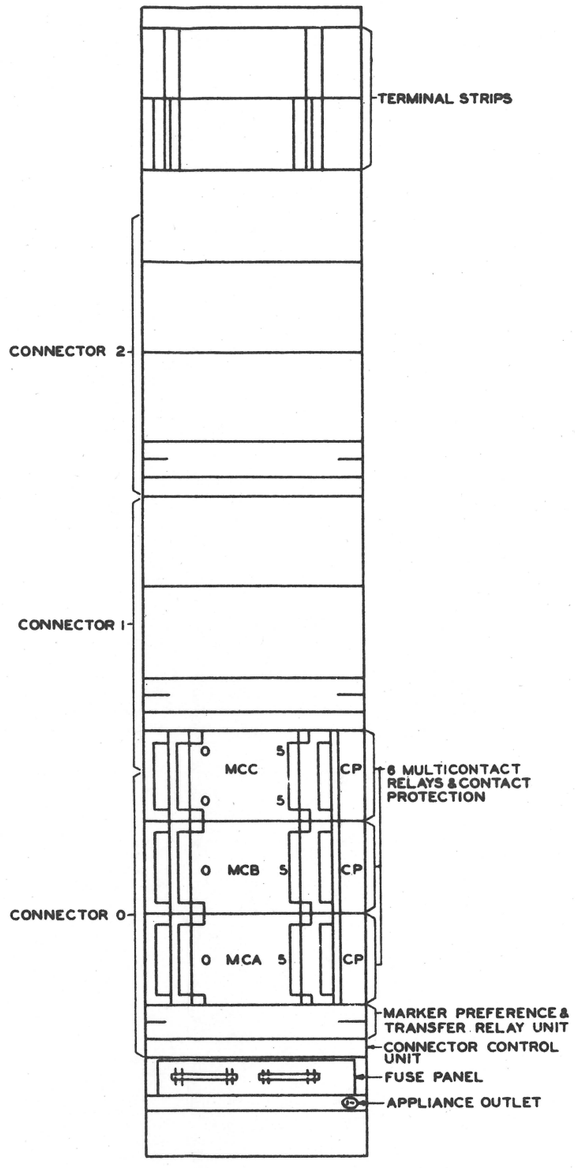


INTERMARKER GROUP SENDER FRAME

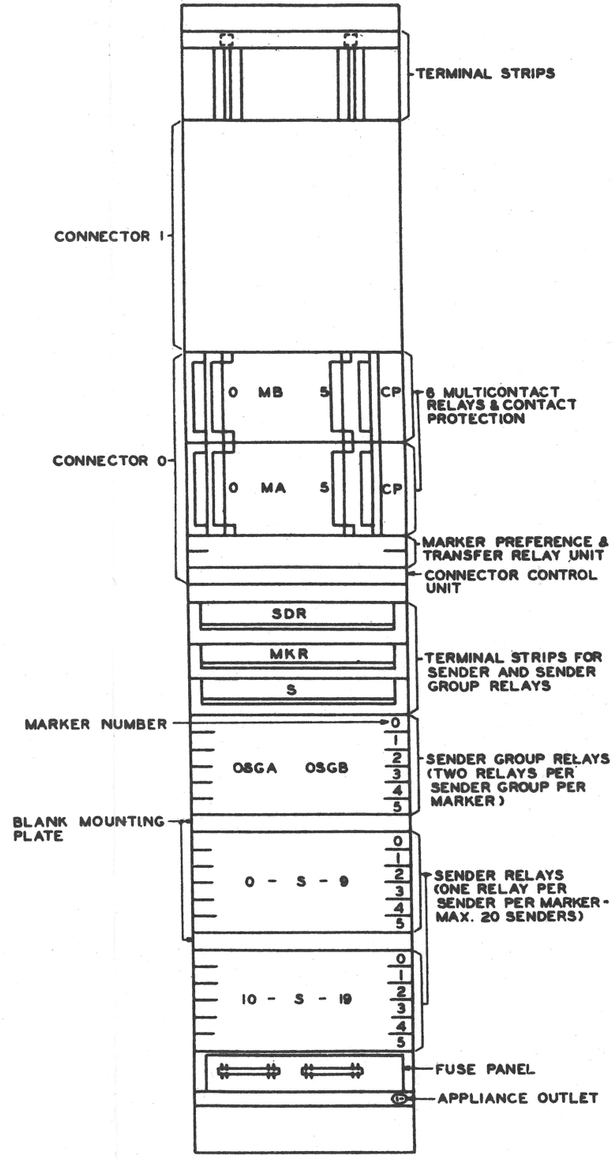
FIG.5-B-141



LINE LINK CONNECTOR FRAME



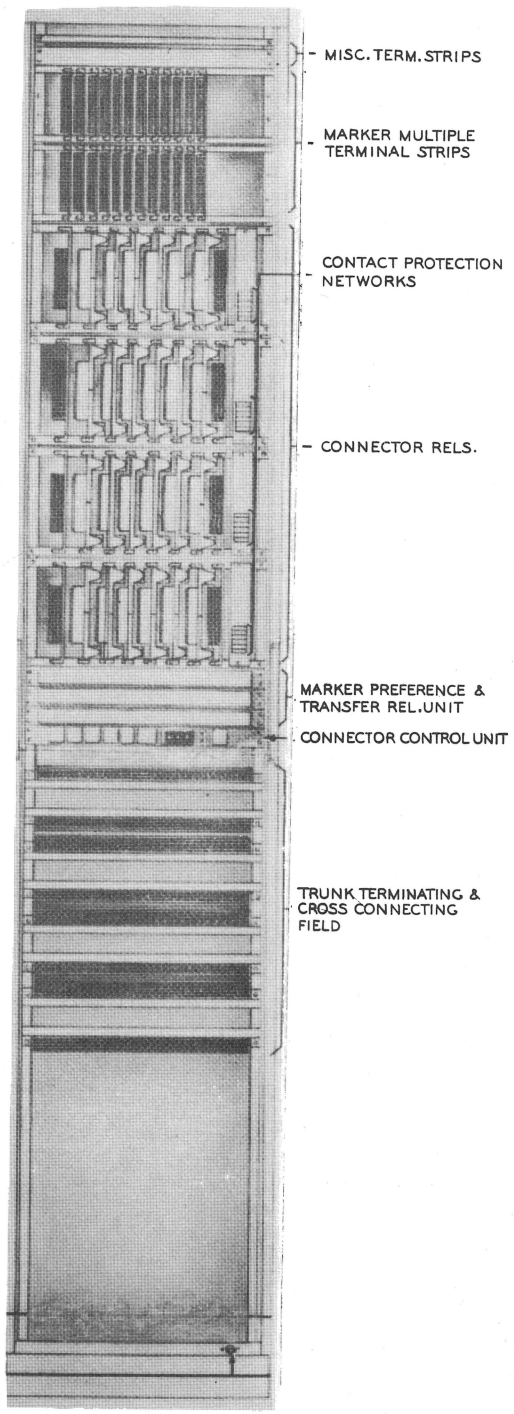
NUMBER GROUP CONNECTOR FRAME



OUTGOING SENDER CONNECTOR FRAME

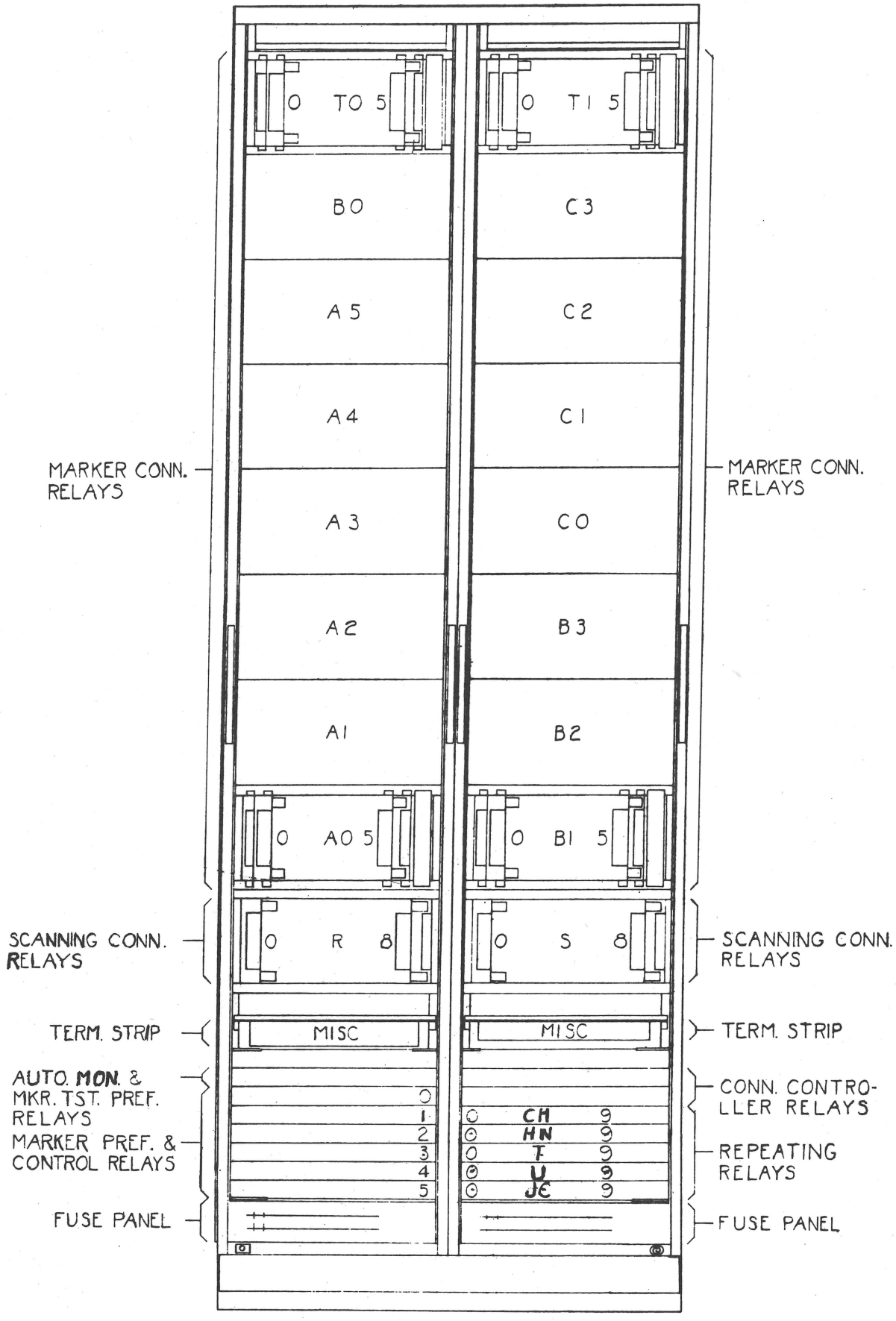
CONNECTOR FRAMES

FIG.5B-150



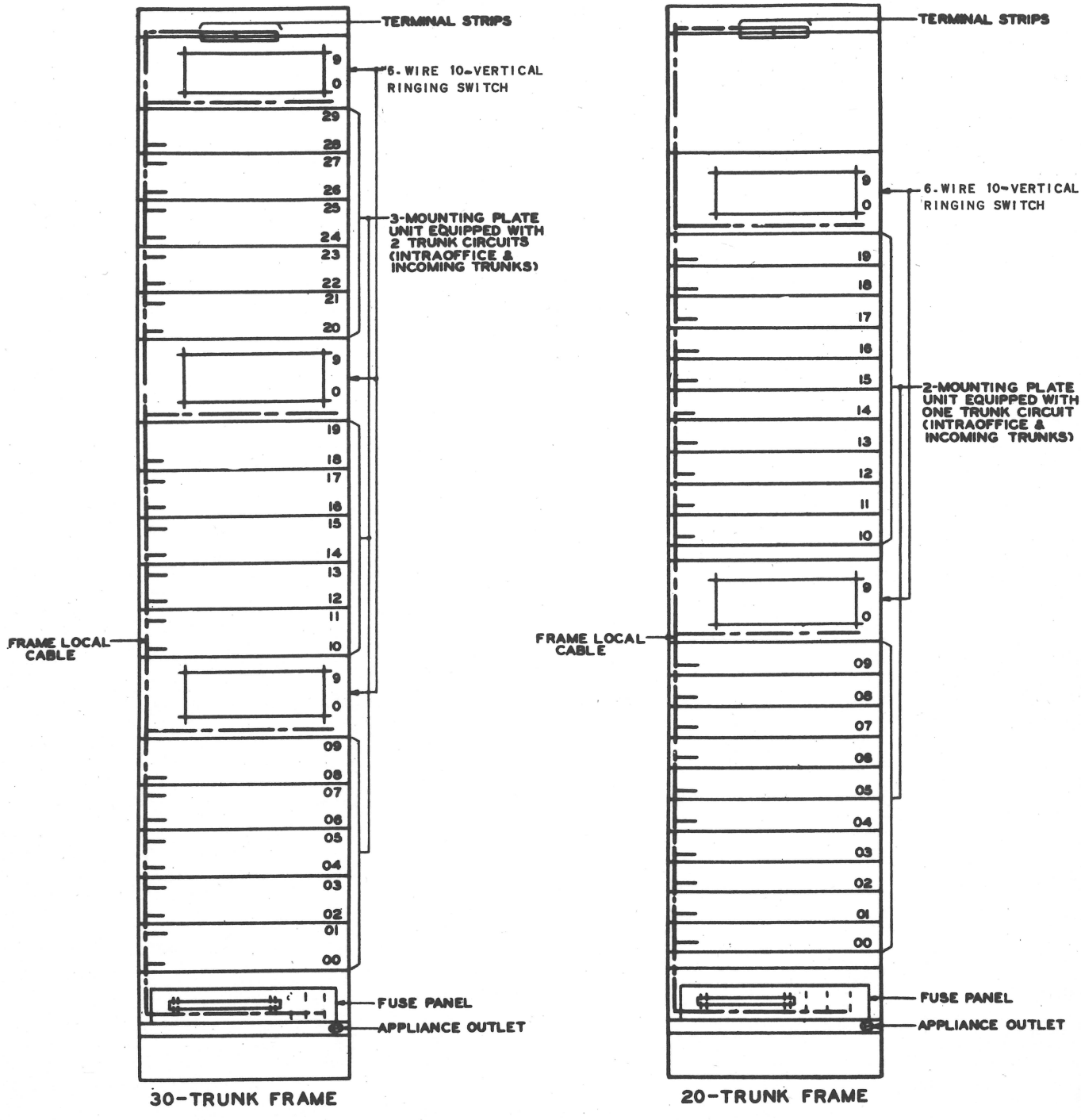
TRUNK LINK CONNECTOR FRAME

FIG. 5B-151



MASTER TEST
CONNECTOR FRAME

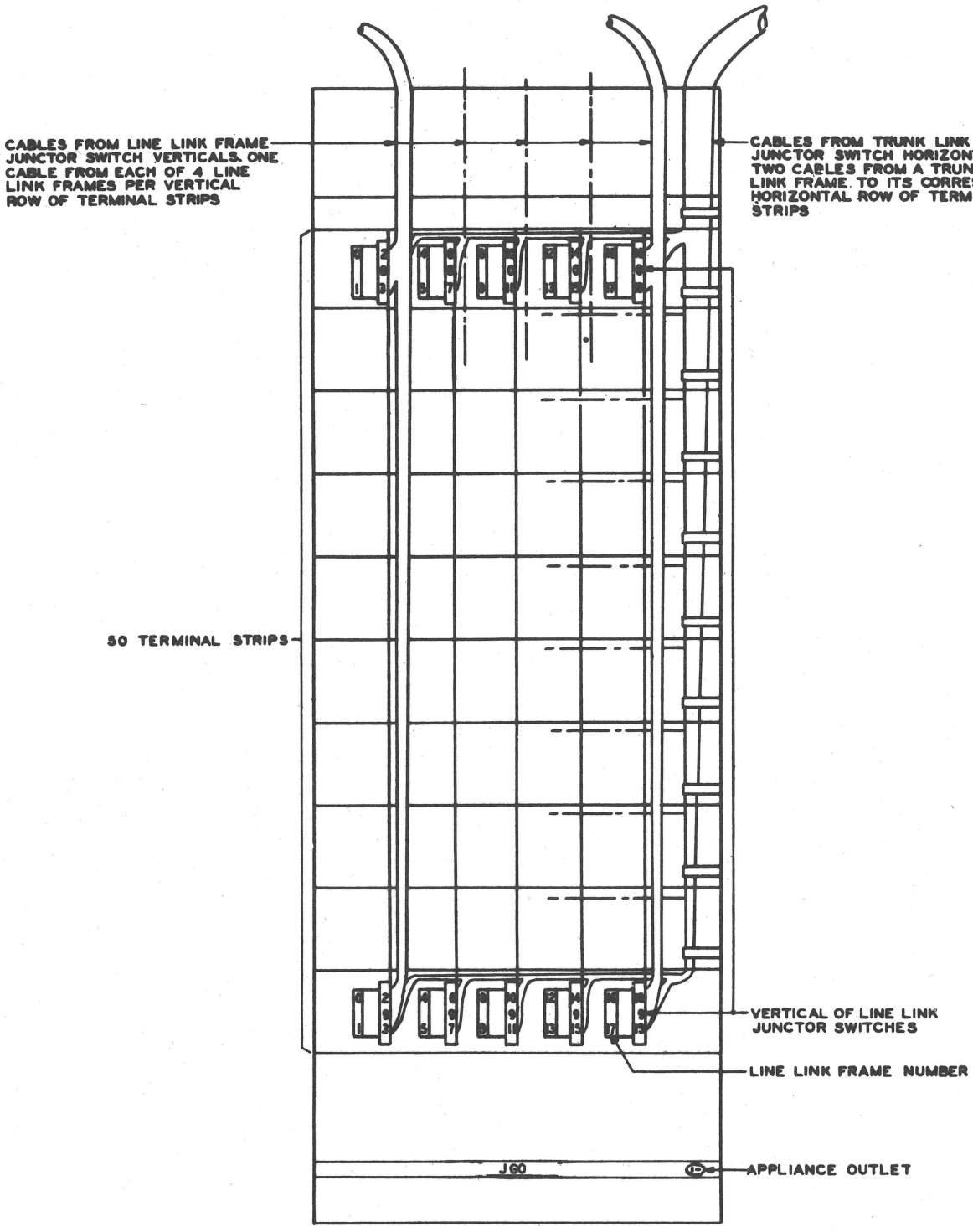
FIG. 5B-152



RELAY RACK FRAMES

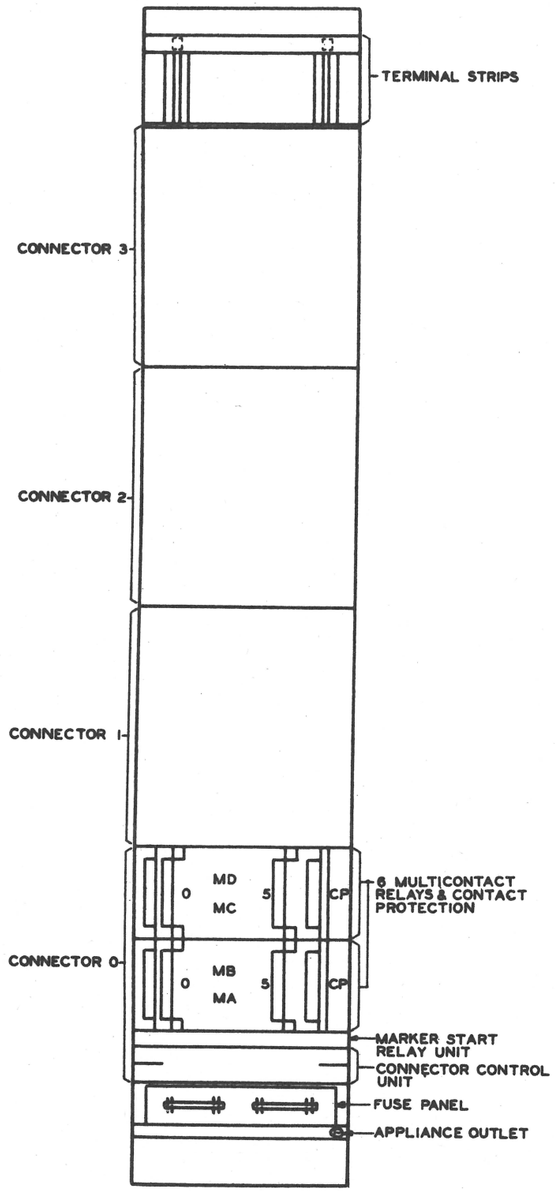
FOR TRUNKS REQUIRING RINGING SWITCH

FIG.5B-160

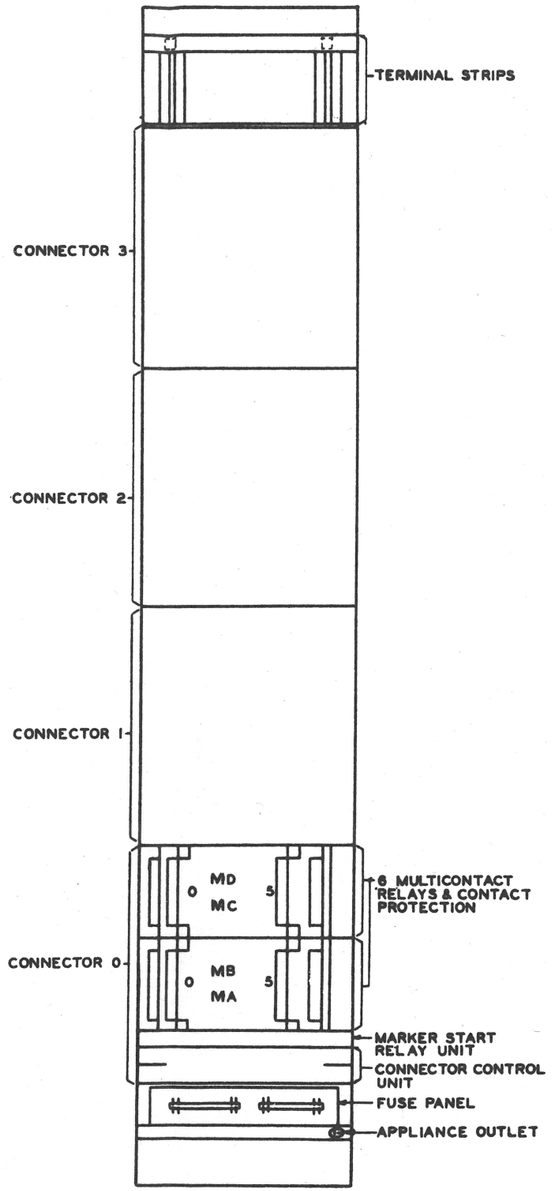

CABLES FROM LINE LINK FRAME JUNCTOR SWITCH VERTICALS. ONE CABLE FROM EACH OF 4 LINE LINK FRAMES PER VERTICAL ROW OF TERMINAL STRIPS
CABLES FROM TRUNK LINK FRAME JUNCTOR SWITCH HORIZONTALS. TWO CABLES FROM A TRUNK LINK FRAME TO ITS CORRESPONDING HORIZONTAL ROW OF TERMINAL STRIPS
50 TERMINAL STRIPS
VERTICAL OF LINE LINK JUNCTOR SWITCHES
LINE LINK FRAME NUMBER
J60
APPLIANCE OUTLET

JUNCTOR GROUPING FRAME ARRANGED FOR
20 LINE LINK AND 10 TRUNK LINK FRAMES

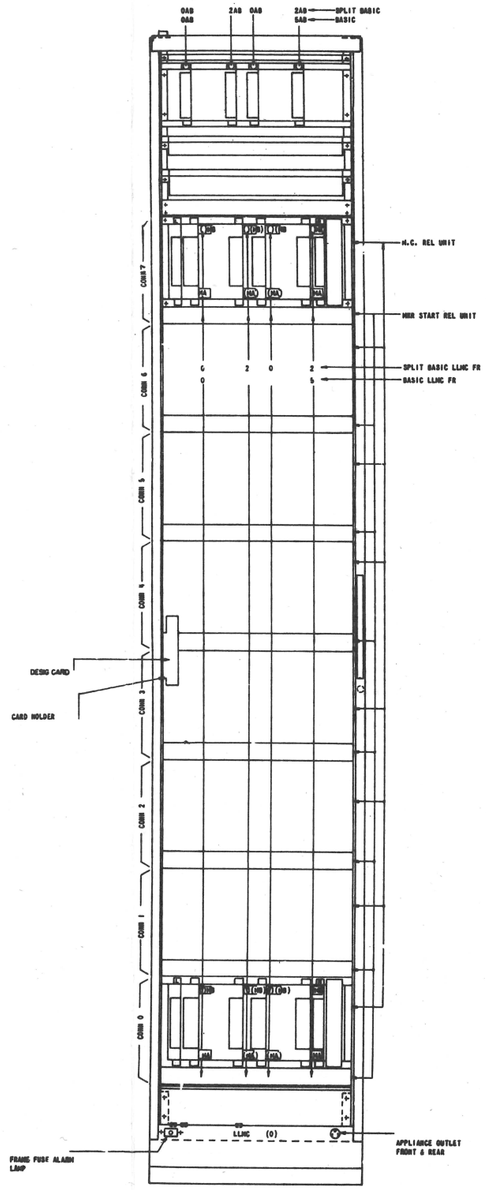
FIG. 5B-170



ORIGINATING REGISTER
MARKER CONNECTOR FRAME



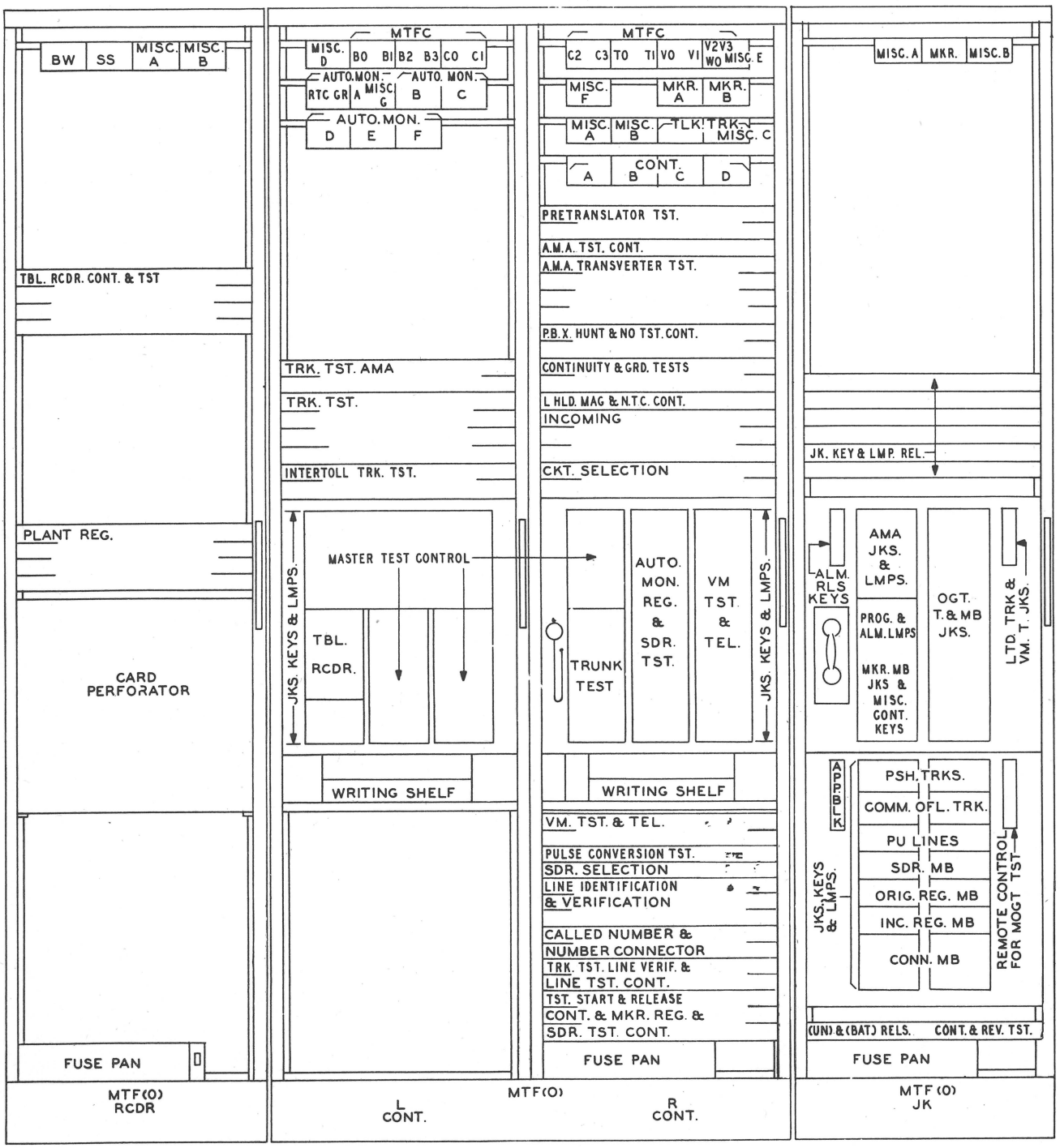
INCOMING REGISTER
MARKER CONNECTOR FRAME



LINE LINK
MARKER CONNECTOR FRAME

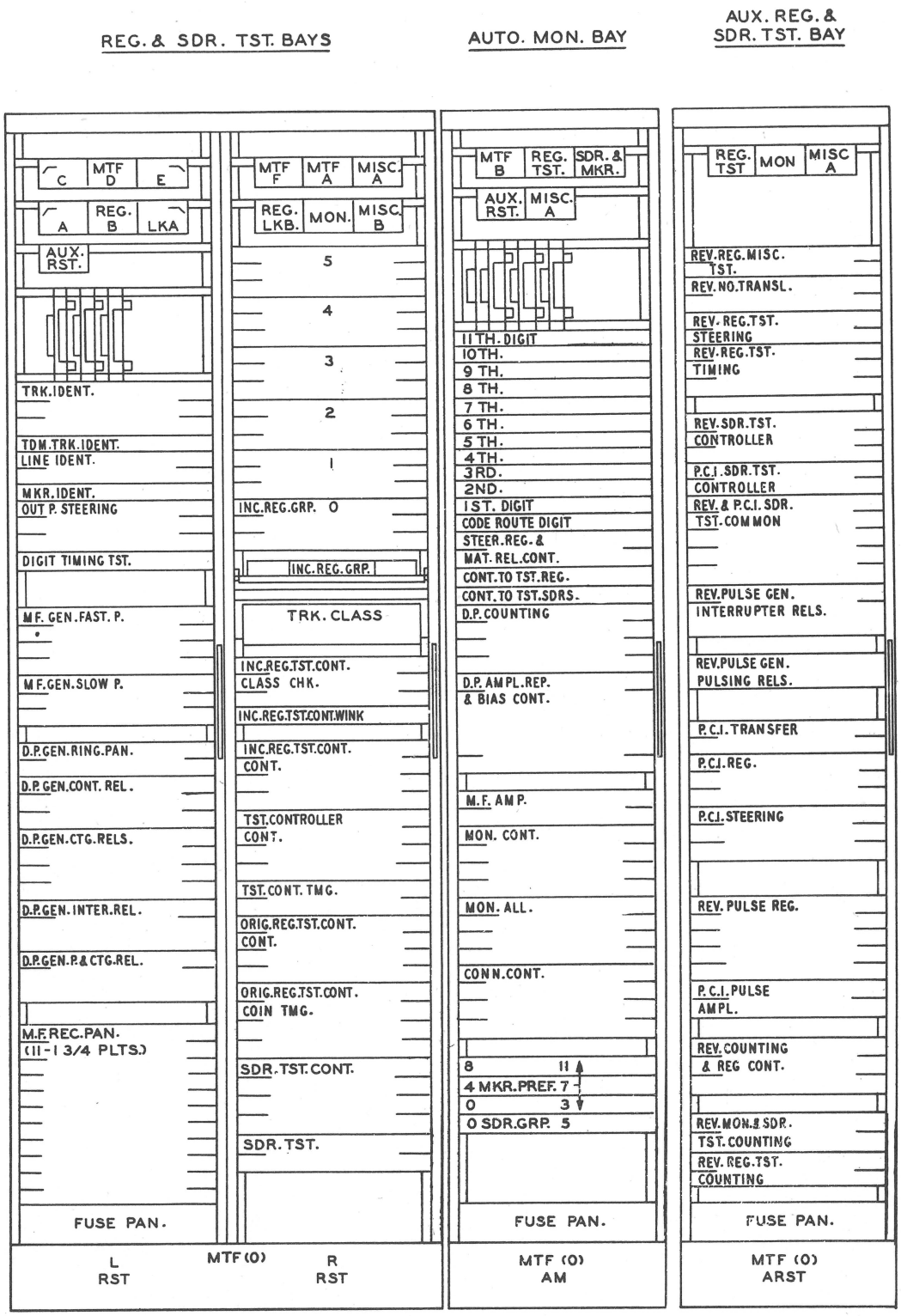
MARKER CONNECTOR FRAMES

FIG.5B-180



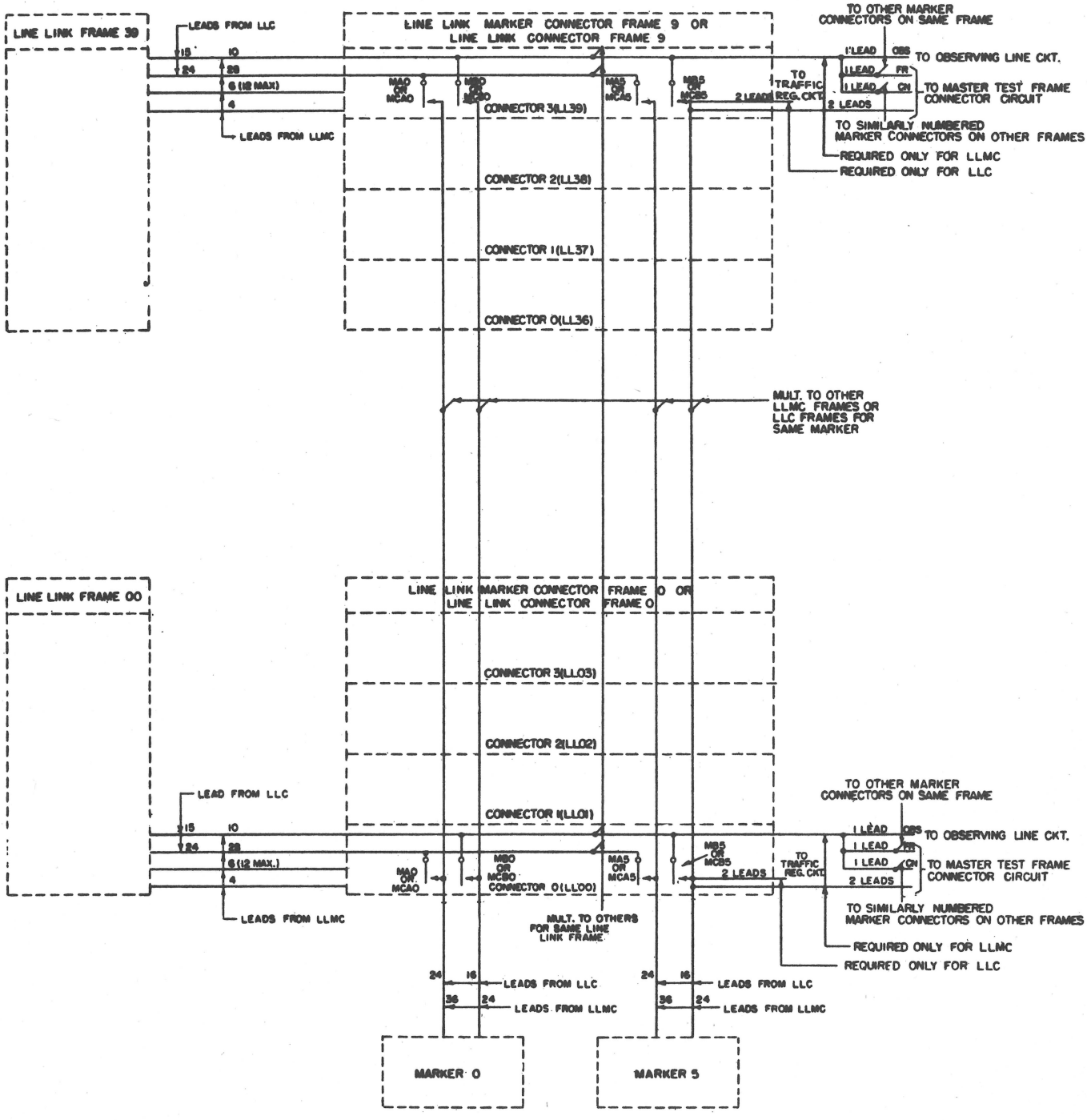
MASTER TEST FRAME
BAYS LOCATED IN MAINTENANCE CENTER

FIG. 5B-190



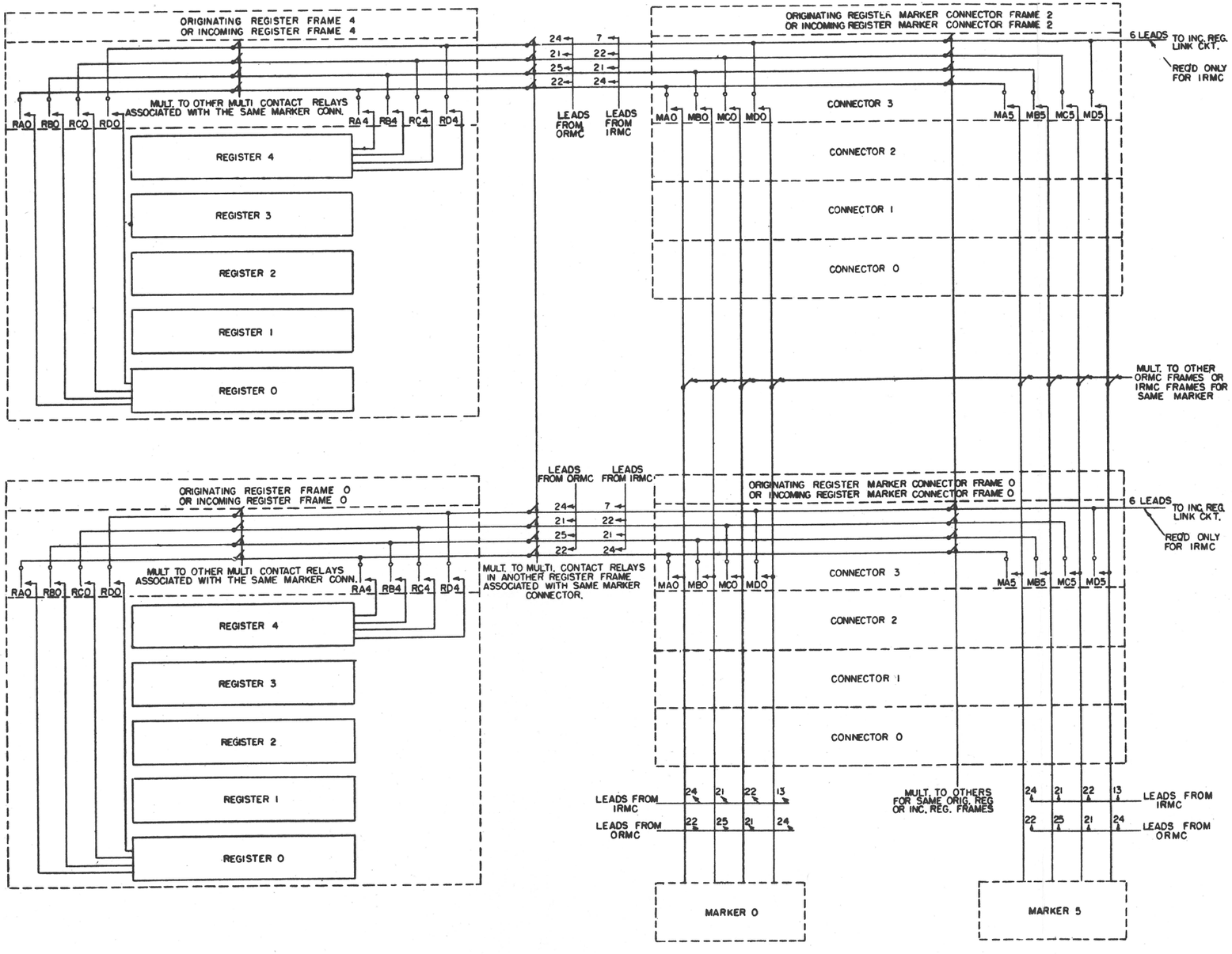
MASTER TEST FRAME
BAYS NOT LOCATED IN MAINTENANCE CENTER

FIG.5-B-191



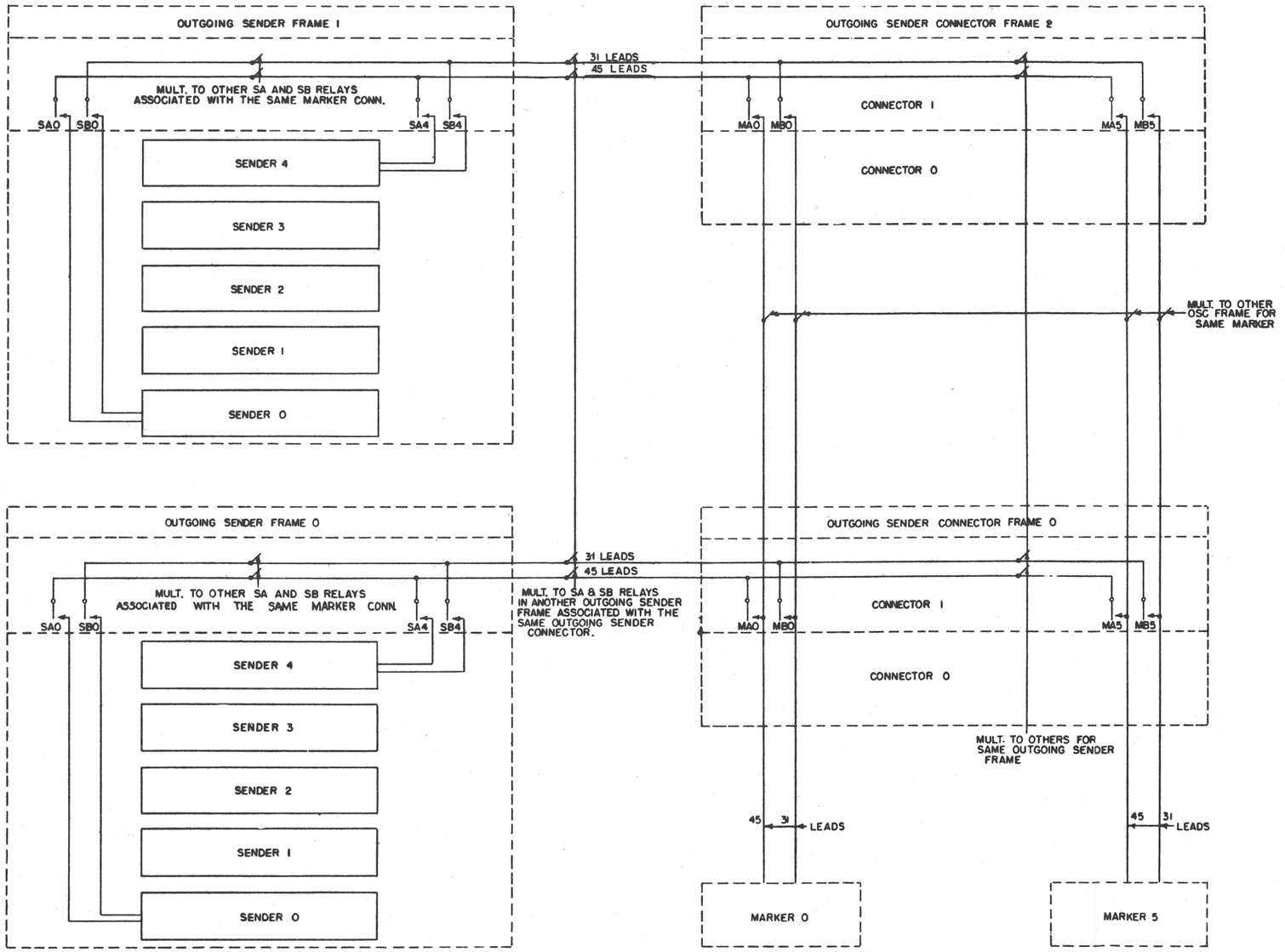
TYPICAL MULTIPLE ARRANGEMENT OF THE
LINE LINK MARKER CONNECTOR FRAMES
OR THE LINE LINK CONNECTOR FRAMES

FIG. 5B-200


ORIGINATING REGISTER FRAME 4
OR INCOMING REGISTER FRAME 4
MULT. TO OTHER MULTI CONTACT RELAYS ASSOCIATED WITH THE SAME MARKER CONN.
RA0 RB0 RC0 RD0
RA4 RB4 RC4 RD4
REGISTER 4
REGISTER 3
REGISTER 2
REGISTER 1
REGISTER 0
24 21 25 22
7 22 21 24
LEADS FROM ORMC
LEADS FROM IRMC
ORIGINATING REGISTER MARKER CONNECTOR FRAME 2
OR INCOMING REGISTER MARKER CONNECTOR FRAME 2
6 LEADS TO INC. REG. LINK CKT.
RECD ONLY FOR IRMC
MA0 MB0 MC0 MD0
MA5 MB5 MC5 MD5
CONNECTOR 3
CONNECTOR 2
CONNECTOR 1
CONNECTOR 0
MULT. TO OTHER ORMC FRAMES OR IRMC FRAMES FOR SAME MARKER
ORIGINATING REGISTER FRAME 0
OR INCOMING REGISTER FRAME 0
MULT. TO MULTI. CONTACT RELAYS IN ANOTHER REGISTER FRAME ASSOCIATED WITH SAME MARKER CONNECTOR.
ORIGINATING REGISTER MARKER CONNECTOR FRAME 0
OR INCOMING REGISTER MARKER CONNECTOR FRAME 0
LEADS FROM IRMC
24 21 22 13
LEADS FROM ORMC
22 25 21 24
MULT. TO OTHERS FOR SAME ORIG. REG OR INC. REG. FRAMES
MARKER 0
MARKER 5

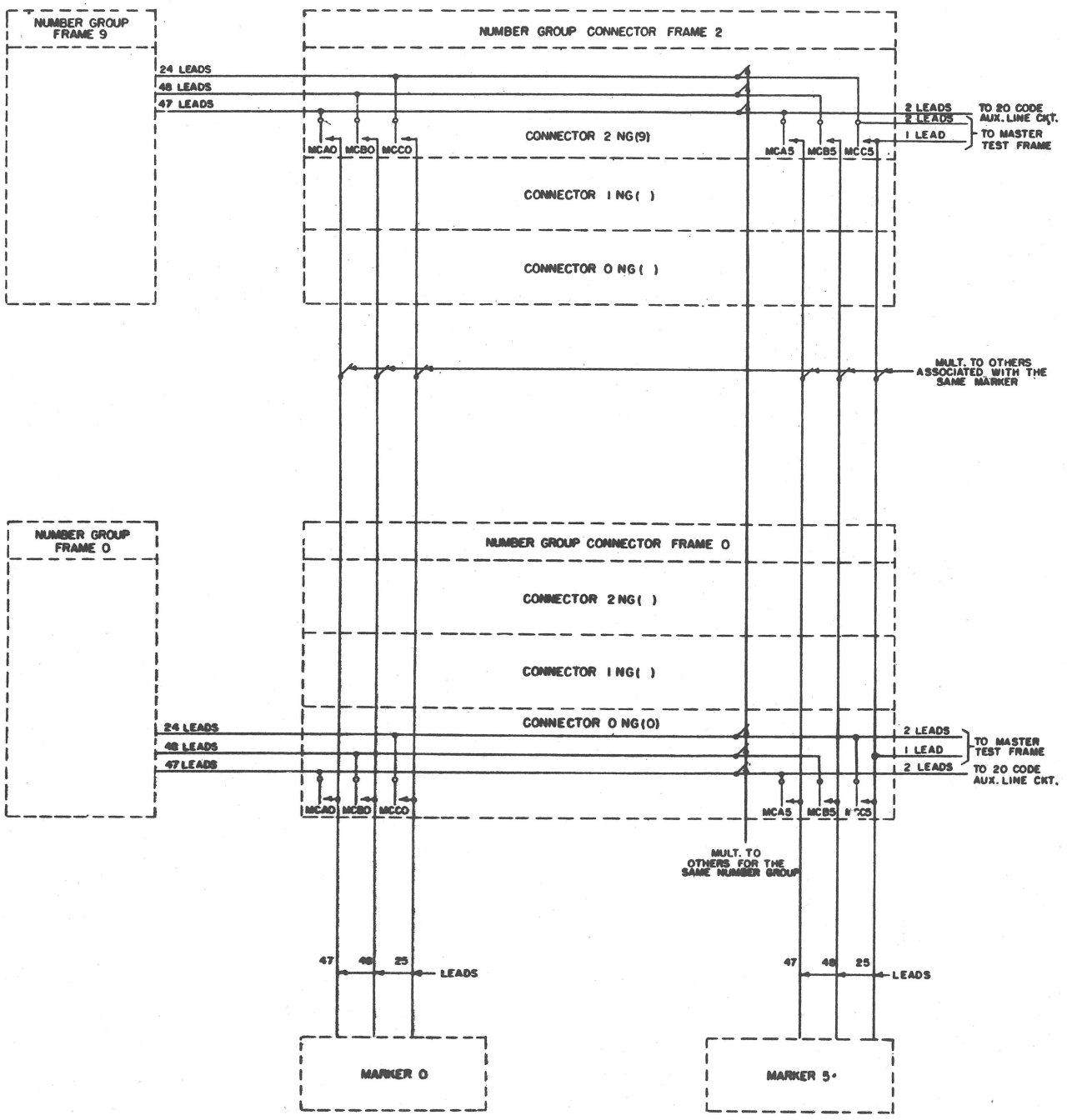
TYPICAL MULTIPLE ARRANGEMENT OF THE ORIGINATING REGISTER FRAMES AND THE ORIGINATING REGISTER MARKER CONNECTOR FRAMES OR THE INCOMING REGISTER FRAMES AND THE INCOMING REGISTER MARKER CONNECTOR FRAMES

FIG.5B-201



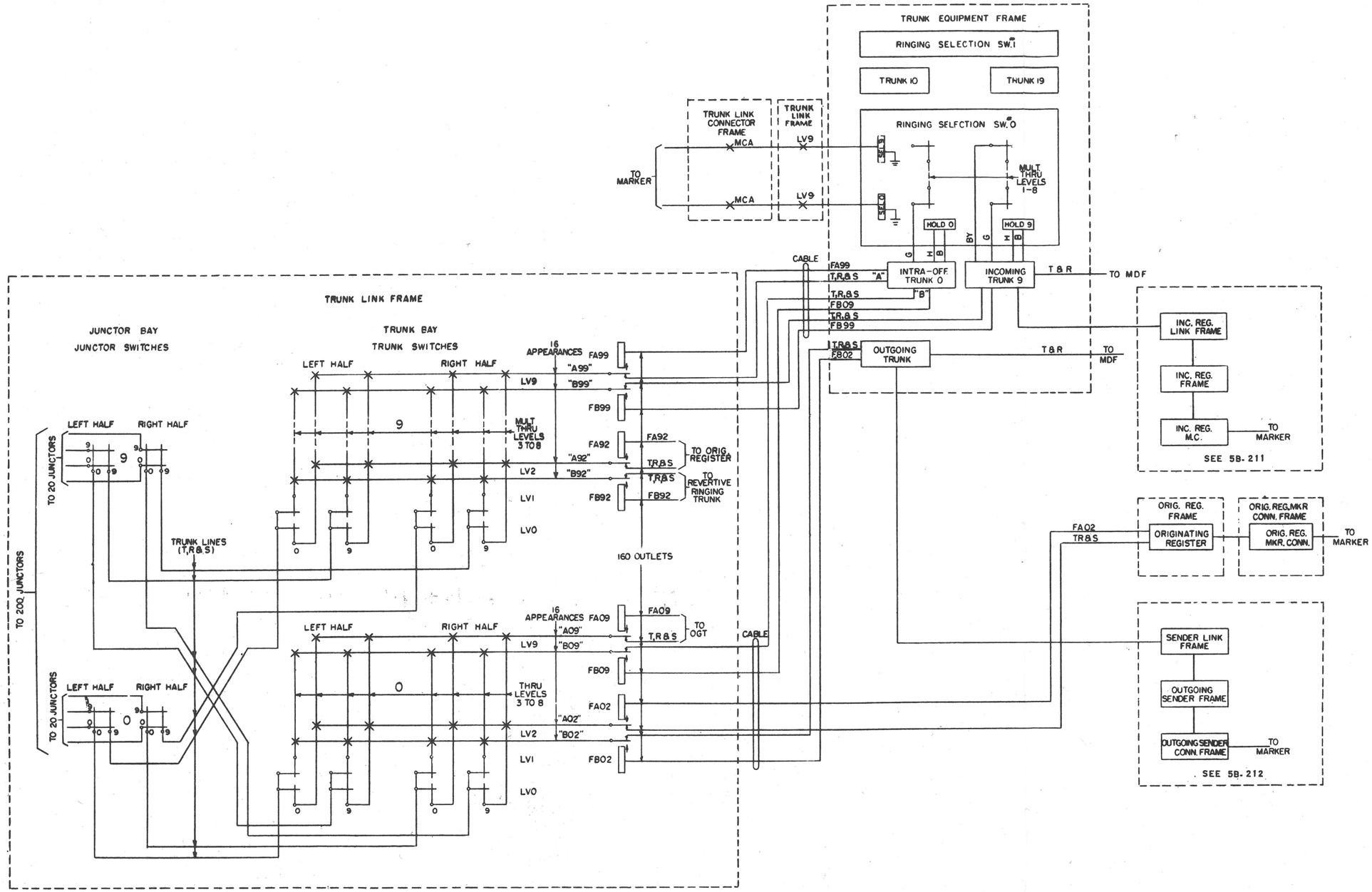
TYPICAL MULTIPLE ARRANGEMENT OF THE OUTGOING SENDER FRAMES AND THE OUTGOING SENDER CONNECTOR FRAMES

FIG.5B-202



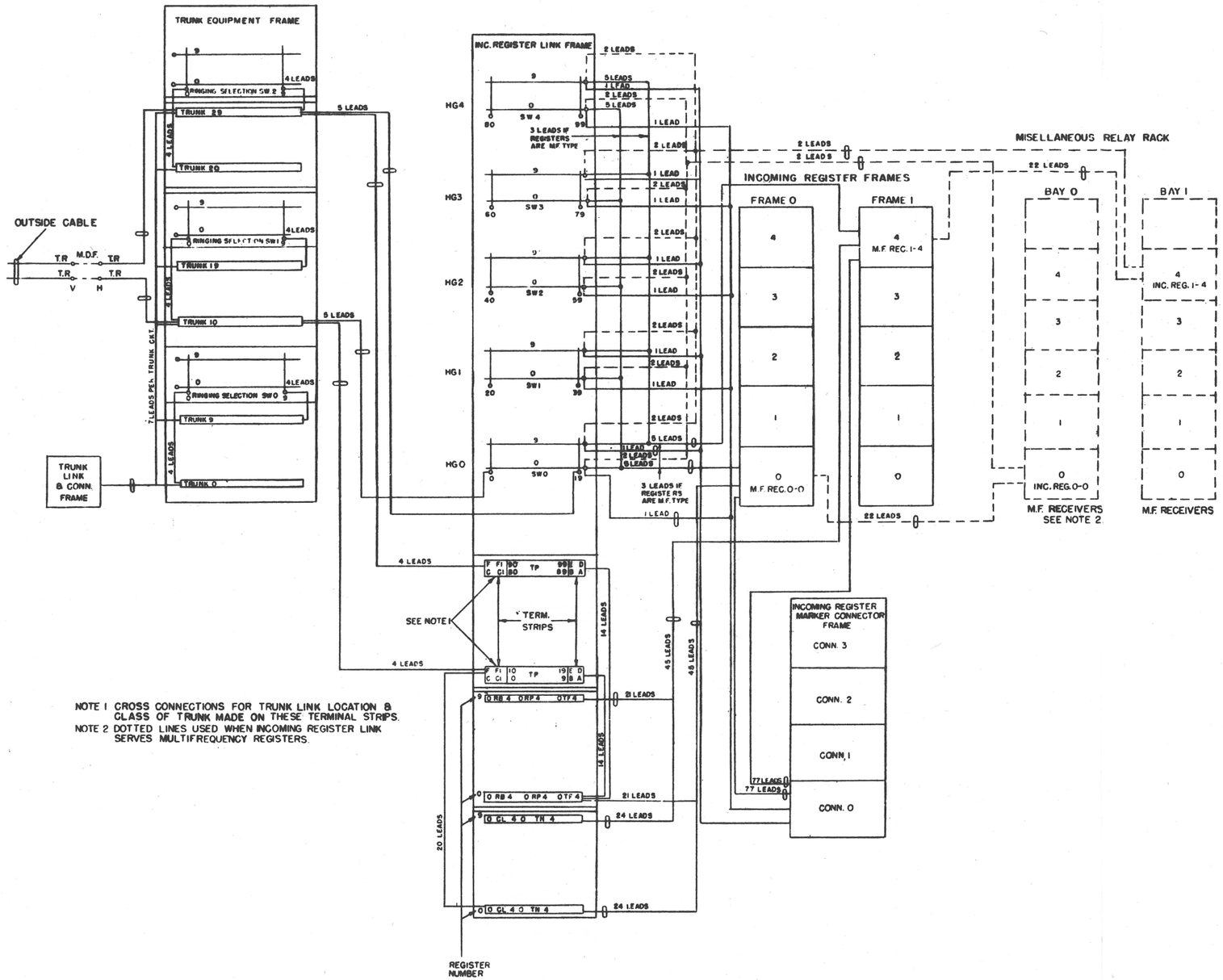
TYPICAL MULTIPLE ARRANGEMENT
OF THE NUMBER GROUP CONNECTOR FRAMES

FIG. 5B-203



TYPICAL CONNECTING ARRANGEMENT
OF TRUNKS & REGISTERS TO THE TRUNK LINK FRAME

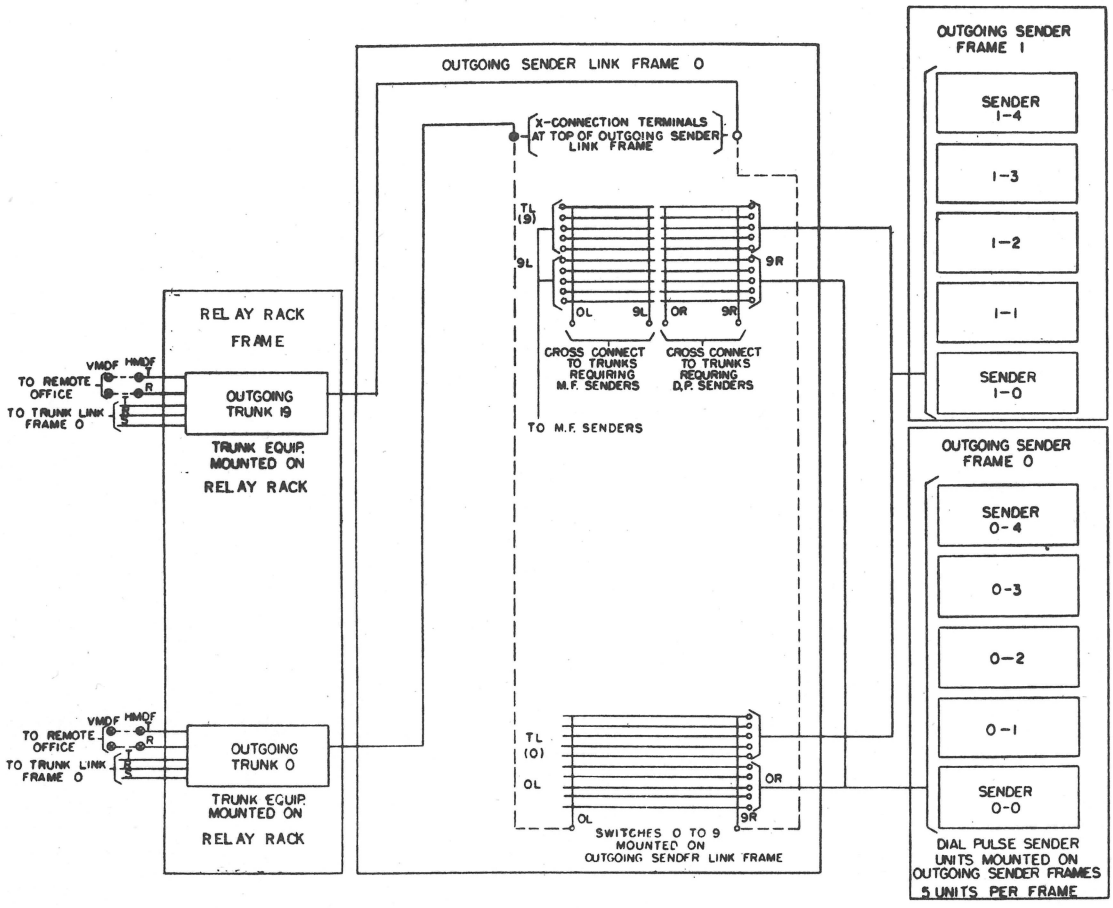
FIG. 5B-210



NOTE 1 CROSS CONNECTIONS FOR TRUNK LINK LOCATION & CLASS OF TRUNK MADE ON THESE TERMINAL STRIPS.
NOTE 2 DOTTED LINES USED WHEN INCOMING REGISTER LINK SERVES MULTIFREQUENCY REGISTERS.

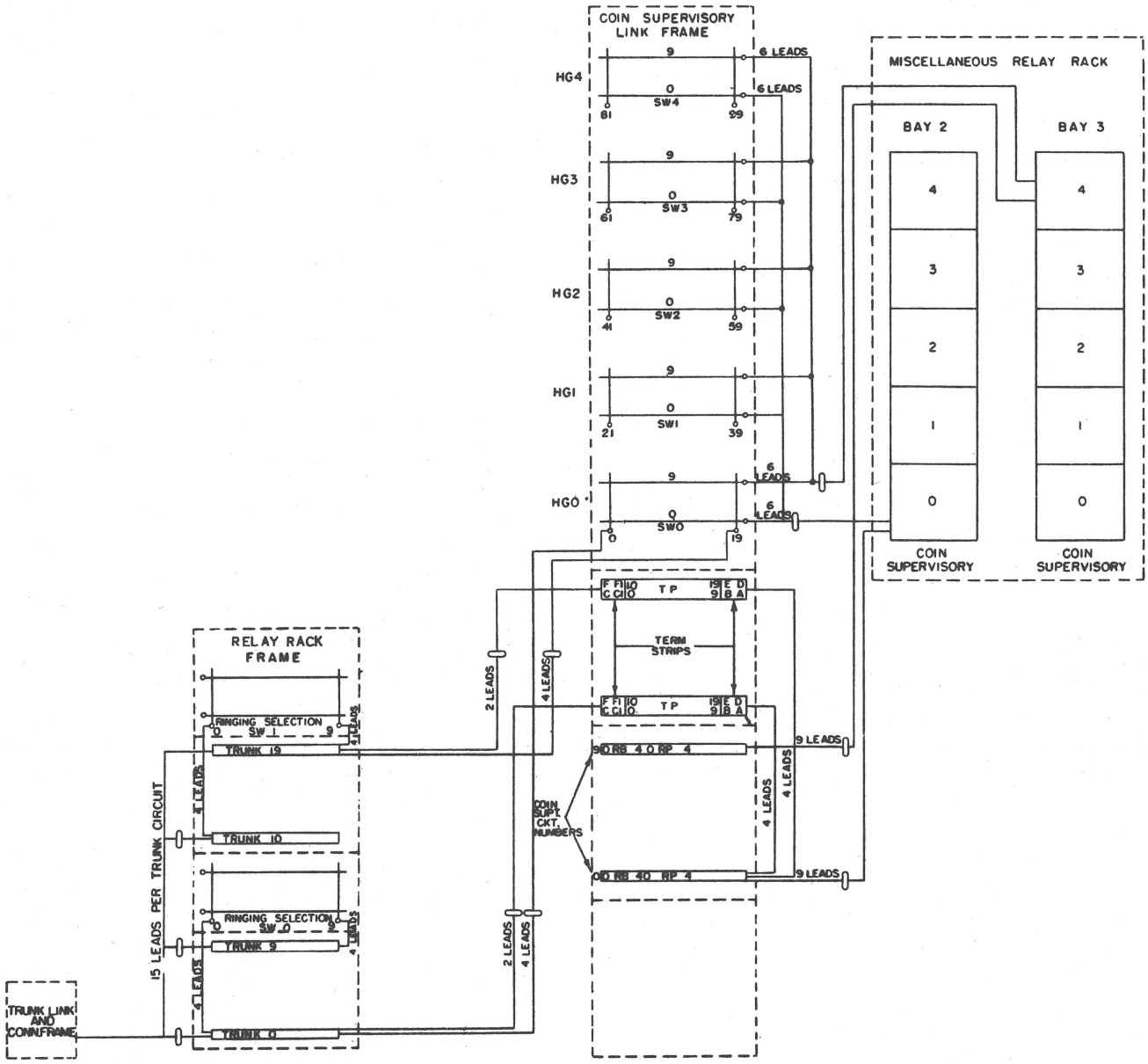
TYPICAL CONNECTING ARRANGEMENTS OF TRUNKS, INCOMING REGISTERS, & INCOMING REGISTER LINKS

FIG. 5B-211



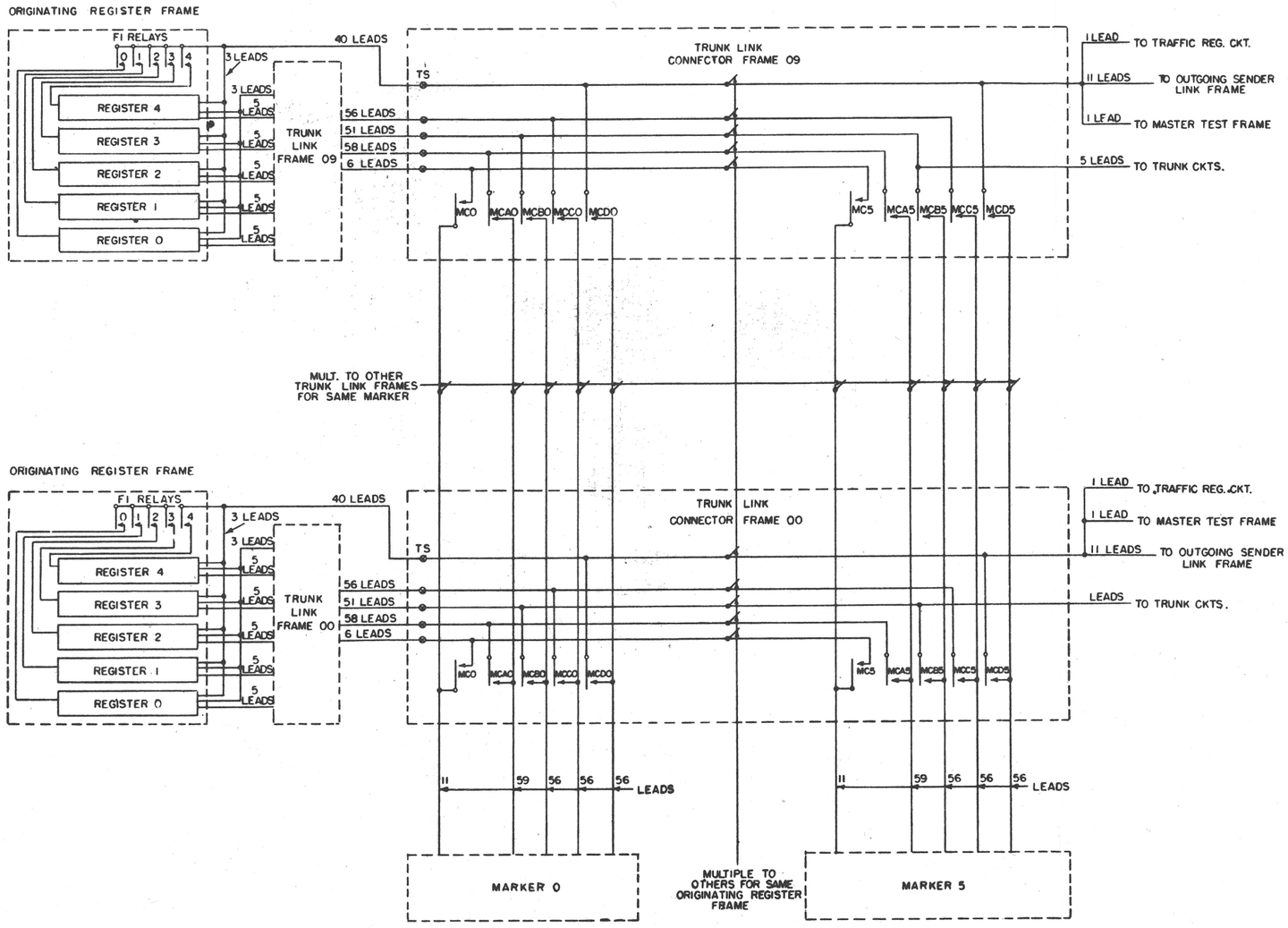
EQUIPMENT ASSOCIATION
TRUNKS, SENDER LINKS, & SENDERS

FIG. 5B-212



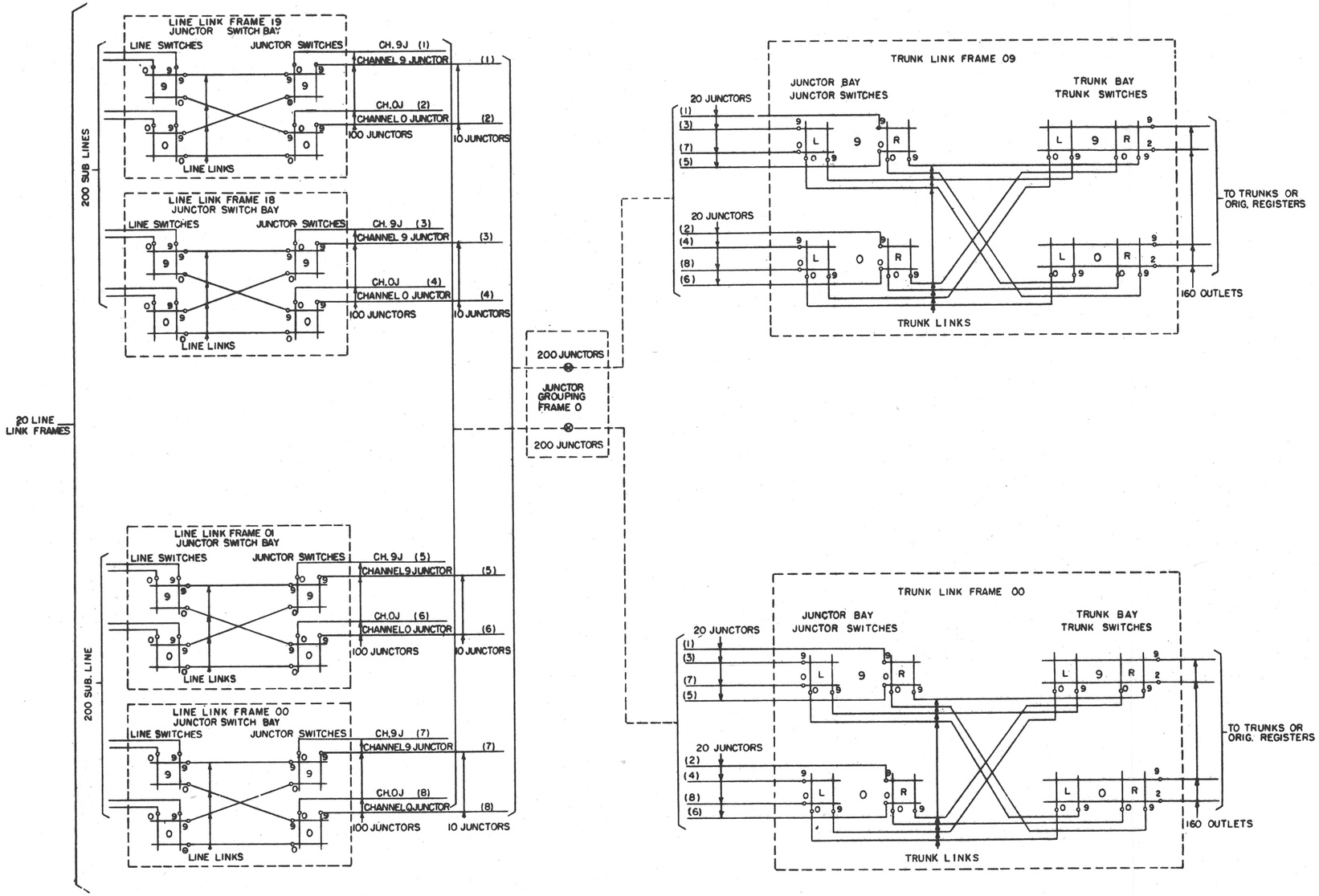
TYPICAL CONNECTING ARRANGEMENTS OF INTRA OFFICE COIN TRUNKS, COIN SUPERVISORY CIRCUITS, AND COIN SUPERVISORY LINKS.

FIG. 5B-213



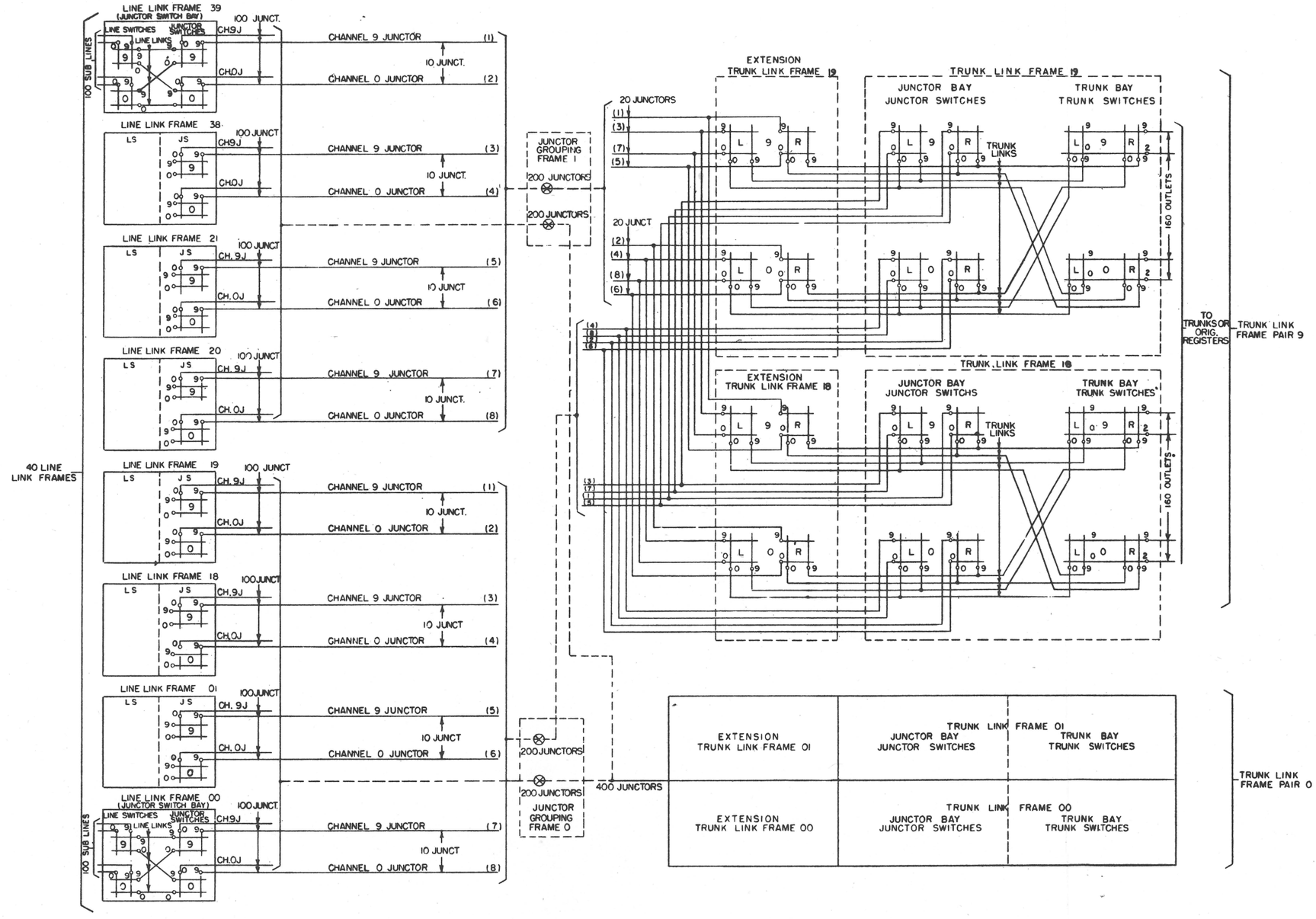
TYPICAL MULTIPLE ARRANGEMENT
OF THE TRUNK LINK CONNECTOR FRAMES

FIG.5B-220



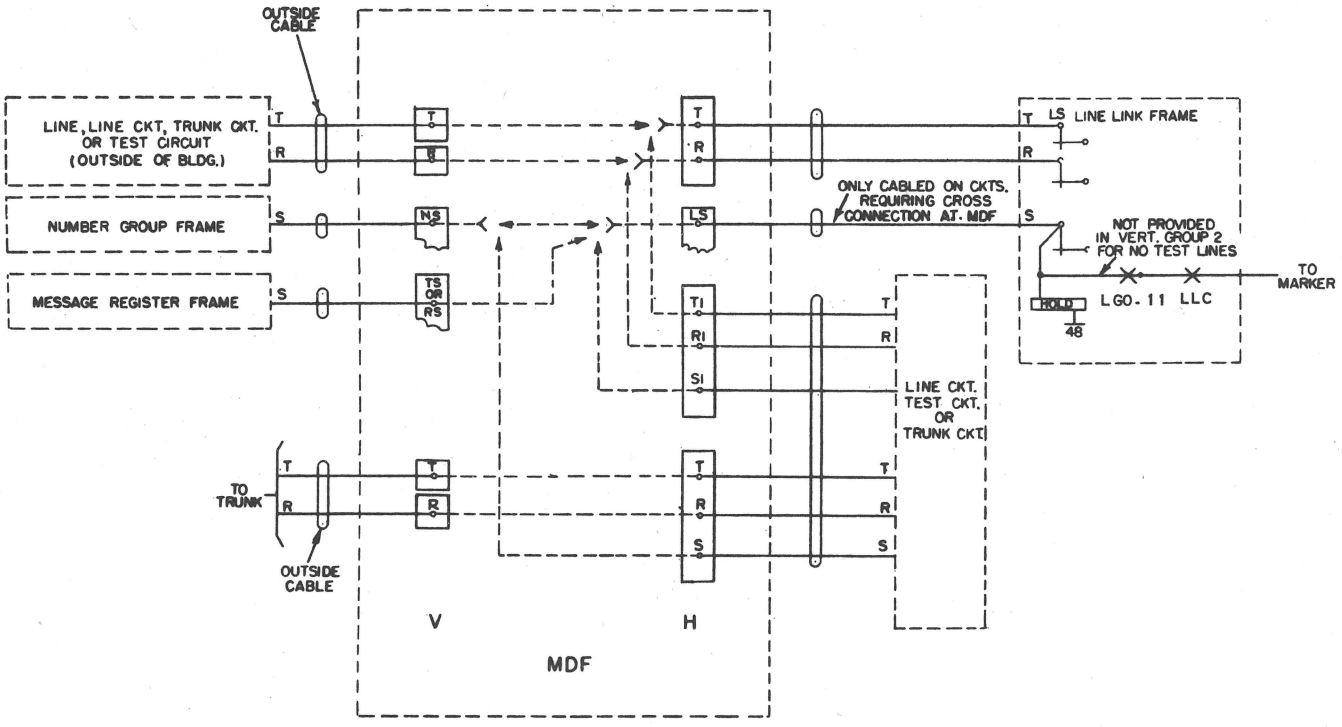
JUNCTOR DISTRIBUTION FOR
20 LINE LINK AND 10 TRUNK LINK FRAMES
INITIAL INSTALLATION

FIG. 5B-230



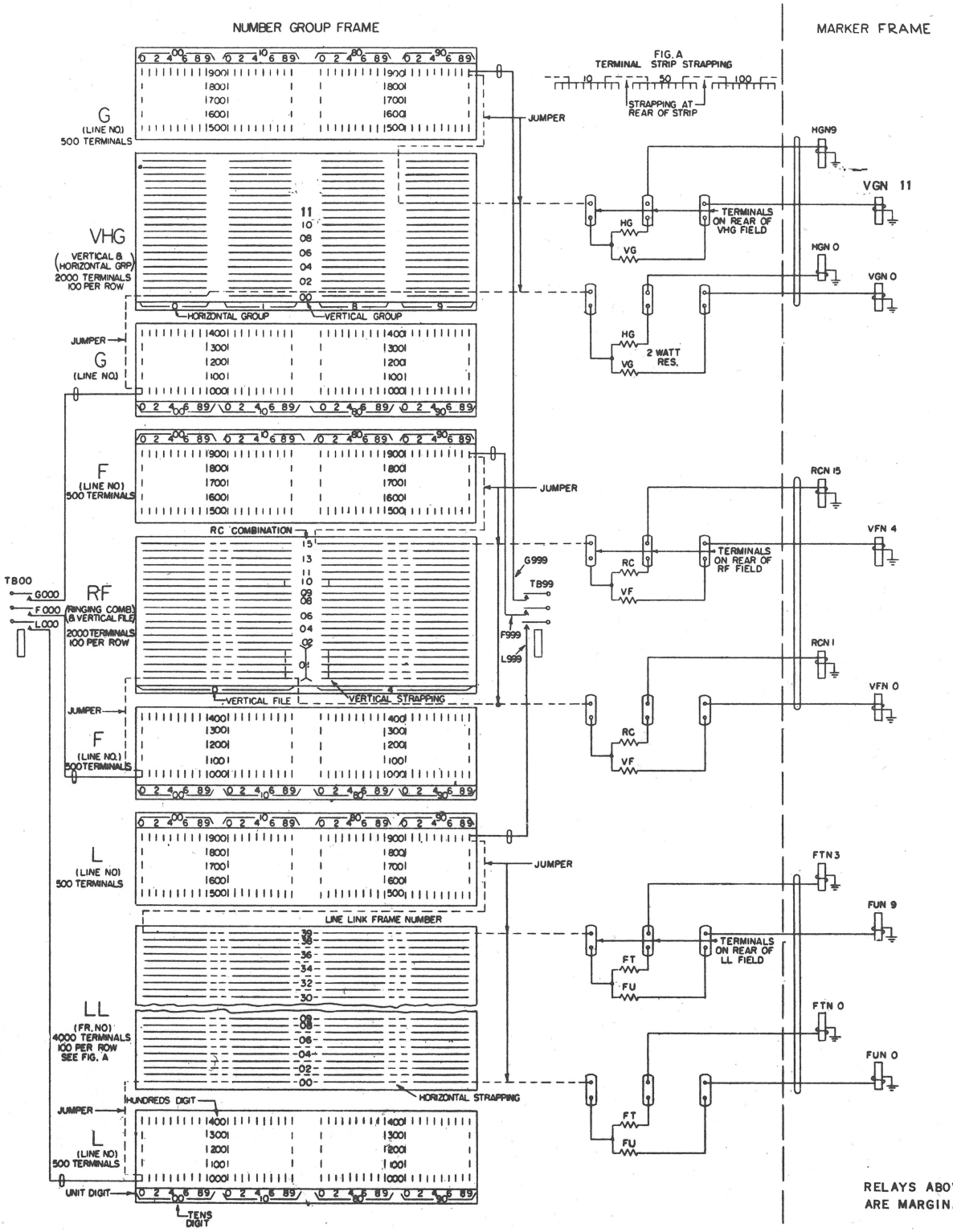
PAIRED OPERATION OF TRUNK LINK FRAMES
AND JUNCTOR DISTRIBUTION FOR
40 LINE LINK FRAMES & 10 TRUNK LINK FRAME PAIRS
INITIAL INSTALLATION

FIG.5B-231



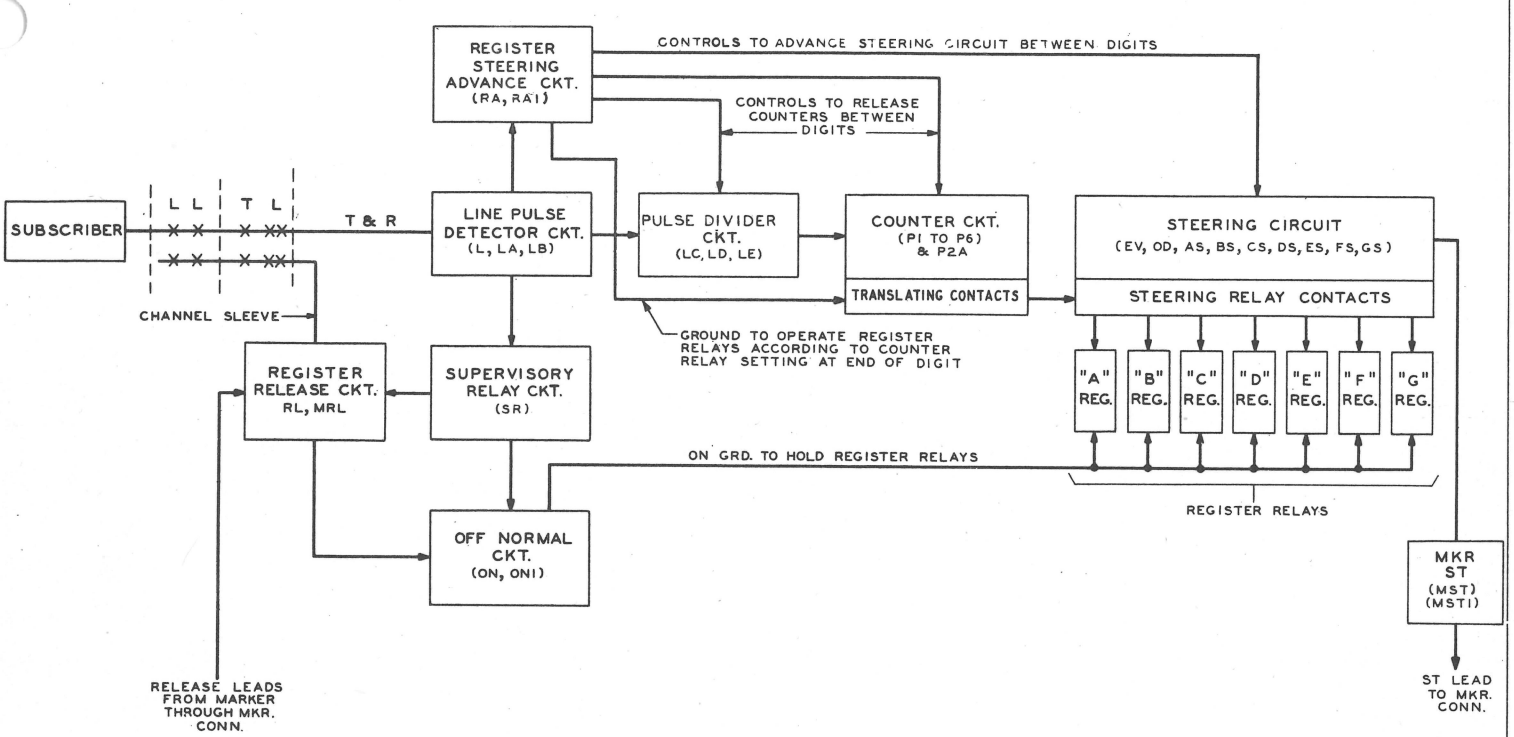
TYPICAL CABLING & CROSS-CONNECTION
ARRANGEMENT OF THE SLEEVE CIRCUIT AT THE MDF

FIG.5B-240



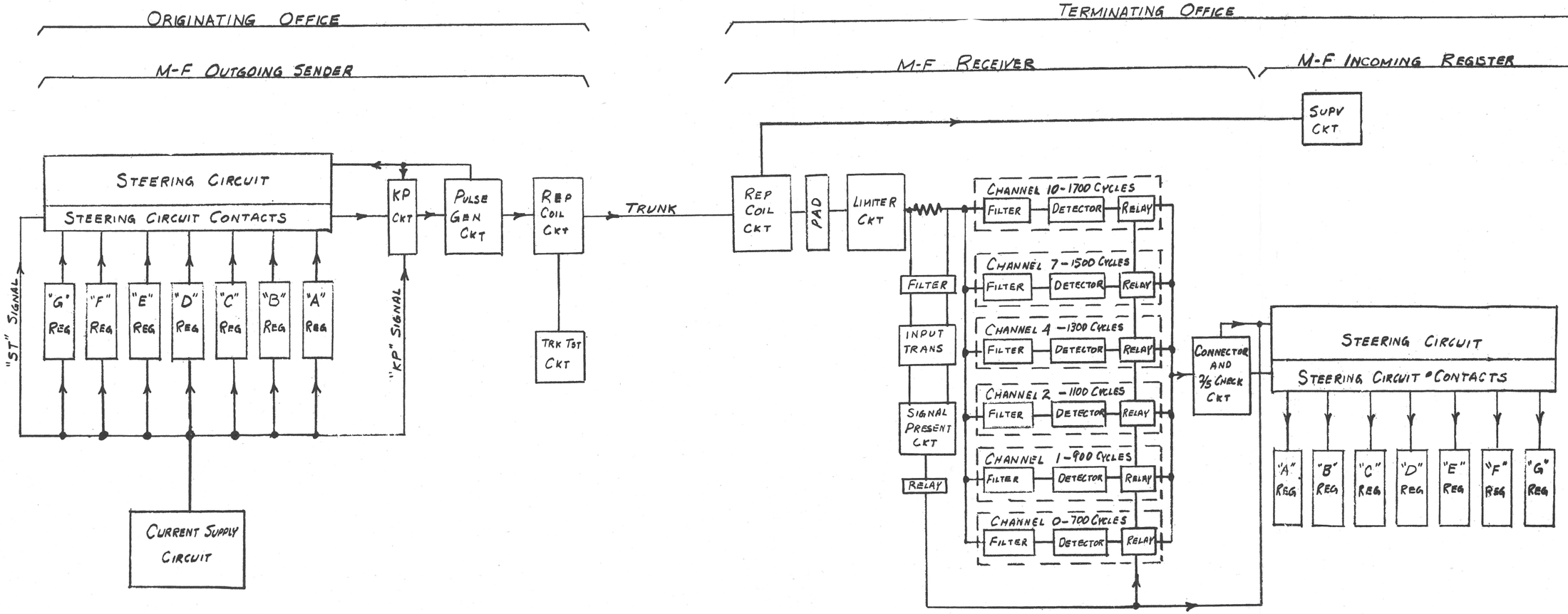
TYPICAL CROSS CONNECTION ARRANGEMENT
IN THE VHG, RF, AND LL FIELDS
FOR 40 LINE LINK FRAMES

FIG. 5B-241


REGISTER STEERING ADVANCE CKT. (RA, RA1)
CONTROLS TO ADVANCE STEERING CIRCUIT BETWEEN DIGITS
CONTROLS TO RELEASE COUNTERS BETWEEN DIGITS
SUBSCRIBER
L L
T L
T & R
LINE PULSE DETECTOR CKT. (L, LA, LB)
PULSE DIVIDER CKT. (LC, LD, LE)
COUNTER CKT. (P1 TO P6) & P2A
TRANSLATING CONTACTS
STEERING CIRCUIT (EV, OD, AS, BS, CS, DS, ES, FS, GS)
STEERING RELAY CONTACTS
CHANNEL SLEEVE
GROUND TO OPERATE REGISTER RELAYS ACCORDING TO COUNTER RELAY SETTING AT END OF DIGIT
"A" REG.
"B" REG.
"C" REG.
"D" REG.
"E" REG.
"F" REG.
"G" REG.
REGISTER RELEASE CKT. RL, MRL
SUPERVISORY RELAY CKT. (SR)
ON GRD. TO HOLD REGISTER RELAYS
REGISTER RELAYS
OFF NORMAL CKT. (ON, ONI)
MKR ST (MST) (MSTI)
RELEASE LEADS FROM MARKER THROUGH MKR. CONN.
ST LEAD TO MKR. CONN.

BLOCK DIAGRAM OF DIAL PULSE COUNTER & REGISTER

FIG.5B-300



BLOCK DIAGRAM OF MULTIFREQUENCY PULSING CIRCUITS

FIG.5B-310